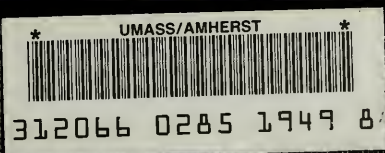


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REPORT
OF
HARBOR AND LAND
COMMISSIONERS


1912

COMPLIMENTS OF
Board of Harbor and Land Commissioners

WILLIAM S. McNARY, CHAIRMAN,
GEORGE E. SMITH,
CHARLES C. PAINE,

STATE HOUSE,
BOSTON.

FREDERICK N. WALES, CLERK OF BOARD.



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THIRTY-FOURTH ANNUAL REPORT

OF THE

BOARD OF HARBOR AND LAND
COMMISSIONERS.

FOR THE YEAR 1912.



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THE STATE BOARD OF PUBLICATION.

The Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1912, covering a period of twelve months, from Nov. 30, 1911, being the thirty-fourth annual report of the Board since its establishment by chapter 263 of the Acts of 1879.

The present organization of the Board is as follows: William S. McNary of Boston, chairman, George E. Smith of Swampscott, Charles C. Paine of Barnstable.

From Dec. 1, 1911, to Nov. 30, 1912, the Board has given 132 formal and informal hearings, and has received 112 petitions for the improvement and protection of rivers, harbors and foreshores, for licenses to build and maintain structures, for privileges in tide waters, great ponds and Connecticut River, to dredge material, to remove material from beaches and for other purposes.

Sixty-five licenses for structures and privileges in tide waters and great ponds have been granted during the year; also 14 permits for dredging, for the removal of material from beaches and for other purposes.

Inspections have been made at various times, by and under the direction of the Board, of work completed and in progress; of sites of authorized work under appropriations made by the Legislature; also upon petitions and plans presented of the sites of proposed work in tide waters; of rivers and harbors, on petitions for improvement under chapter 481, Acts of 1909; work done and in progress on the Cape Cod Canal; various structures built under licenses; town boundary survey work.

During the year 12 contracts were made, involving the estimated expenditure of \$153,494.94. A list of these contracts and those pending, with details relating thereto, may be found in the Appendix.

THE IMPROVEMENT AND PROTECTION OF RIVERS, HARBORS, TIDE WATERS AND FORESHORES.

By chapter 481 of the Acts of the year 1909 the Board was authorized and directed to undertake such work for the improvement, development, maintenance and protection of rivers, harbors, tide waters and foreshores within the Commonwealth as it may deem to be reasonable and proper, and to expend during the years 1910, 1911 and 1912 a sum not exceeding \$300,000, not more than \$100,000 to be expended in any one year, provided, however, that an unexpended balance in any year might be used in the succeeding year.

This act also provided that the Board shall consider the general public advantage of the proposed work, the local interest therein as manifested by municipal or other contributions therefor, the importance of the industrial or commercial and other interests to be especially served thereby, and any other material considerations affecting the feasibility, necessity or advantage of the proposed work or the expenditure therefor. It was further provided that no work shall be commenced until after a public hearing has been held and a survey and estimate of cost has been made; that a city or town might appropriate money for the improvement of rivers, harbors, tide waters and foreshores within its jurisdiction, the money so appropriated to be paid into the State treasury, to be expended by the Board for said purposes; and that the city or town might assume liability for all damages to property suffered by any person by any taking of land, or of any right, interest or easement in land within the city or town made by the Board for the purposes authorized by the act. A table showing contributions by municipal authorities and others, allotments and expenditures, to Dec. 1, 1911, under authority of chapter 481 of the acts of 1909, is printed in the report of the Board for 1911, page 63. By chapter 642 of the Acts of 1912 the Board is authorized —

To expend during the years nineteen hundred and thirteen, nineteen hundred and fourteen and nineteen hundred and fifteen, a sum not exceeding four hundred and fifty thousand dollars for the improvement, development, maintenance and protection of rivers, harbors, tidewaters and foreshores within the commonwealth now under the jurisdiction of said board. . . . The board shall not expend more than one hundred and fifty thousand dollars in any one year, except that an unexpended balance in any year may be used in the succeeding year for the said purpose.

Petitions under the act of 1909 aforesaid have been presented during the year for surveys and improvements in the following localities: Annisquam River, Gloucester; Bass River, Yarmouth; Beverly harbor; Buzzards Bay, Falmouth; Concord River, Billerica; Cuttyhunk harbor; Herring River, Harwich; Hyannisport; Little River, Gloucester; Lynn Harbor; Manchester harbor; Haulover Beach, Nantucket; Nantucket harbor; Onset Bay; Pamet River, Truro; Plymouth harbor; Rock harbor, Orleans; Salem harbor; Sandwich harbor; Saugus River; Scituate harbor; Witchmere harbor; Woods Hole.

The action taken upon these several petitions, as well as statements concerning Boston harbor and other harbors and rivers, and the various surveys, examinations and improvements made between 1893 and Nov. 30, 1912, inclusive, follow: —

BOSTON HARBOR.

Dredging off the Southerly Shore of South Boston.

The dredging of an anchorage basin off the southerly shore of South Boston, near the clubhouse of the Mosquito Fleet Yacht Club, and a portion of the channel leading to this basin, under contract of Nov. 18, 1910, with the Eastern Dredging Company, which was reported upon in the last annual report of this Board, was completed May 25, 1912.

The total excavation was 113,681 cubic yards.

Amount expended during the year, \$9,404.15.

Total amount expended in this locality, \$126,972.44.

Previous to the appointment of the Directors of the Port of Boston on Dec. 6, 1911, and up to Dec. 1, 1911, improvements by dredging in Boston harbor and its tributaries were carried into effect under the direction and charge of this Board. These improvements represent an expenditure by the Commonwealth, between 1874 and 1911, inclusive, of approximately \$2,900,000.

The expenditure by the United States to the close of the fiscal year ending June 30, 1911, for the improvement of Boston harbor was \$10,402,687.45.

The appropriations and expenditures by the State for Boston main harbor, including the Commonwealth's flats at South Boston and East Boston and the Commonwealth Pier, from 1870 to 1911, inclusive, were as follows:—

Boston Main Harbor.—From 1870 to 1911 inclusive.

LOCALITY.	Character of Work.	Total Appropriation.	Total Expenditure.
Anchorage basin,	Dredging,	\$1,002,500 00	\$504,268 50
Boston harbor,	Dredging,	165,000 00 ¹	580,987 44
Commonwealth's flats at East Boston, .	Harbor improvement, .	3,100,000 00 ²	35,084 27
Commonwealth's flats at South Boston,	Harbor improvement, .	4,838,902 03	3,585,500 60
Commonwealth Pier,	Wharf and dock, . . .	400,000 00	381,877 09
Drydock,	Investigation,	5,000 00	435 50
Metropolitan dock system,	Investigation,	1,000 00	644 15
Northern Avenue,	Bridge,	260,000 00	260,000 00
South Bay improvement fund,	Dredging,	59,437 50	57,341 24
Totals, . . . . .	. . . . .	\$9,831,839 53	\$5,406,138 79 ³

The total expenditures by the State from 1893 to Nov. 30, 1912, inclusive, for surveys and examinations and for the improvement and protection of rivers, harbors and foreshores, other than Boston main harbor and its tributaries within the limiting line defined in chapter 748 of the Acts of 1911, under special acts of the Legislature, chapter 481 of the Acts of 1909, and the appropriations for survey and improvement of harbors, were \$1,393,810.36, of which \$218,597.17 was contributed by municipalities and others, and \$1,175,213.19 paid under special acts and from the appropriations for survey and improvement of harbors and improvement of rivers and harbors.

The total expenditures under chapter 481 of the Acts of 1909, including contributions made by municipalities and others under

¹ In addition, \$417,983.94 from income of harbor compensation fund.

² The expenditure of \$3,000,000 from this appropriation was restricted by the provisions of chapter 648 of the Acts of 1910, and no portion thereof was actually expended.

³ This expenditure has been increased by work done under the Directors of the Port of Boston subsequent to Nov. 30, 1911.

authority of said act, the amounts due under completed contracts, and estimated amounts to be paid for work contracted for are \$359,171.05.

The expenditures on River and Harbor improvements by the United States government from its establishment to the close of the fiscal year ending June 30, 1911, as stated in Senate Document No. 382, 62d Congress, 2d session, are as follows: —

In Massachusetts.

Bass River,	\$20,150 34
Beverly harbor,	35,015 00
Boston harbor,	10,402,687 45
Buzzards Bay harbor,	2,500 00
Canapitset Channel,	5,312 54
Chatham harbor,	15,971 36
Cohasset harbor,	10,000 00
Dorchester Bay and Neponset River,	94,584 55
Duxbury harbor,	32,000 00
East Dennis breakwater,	7 57
Edgartown harbor,	25,000 00
Essex River,	30,000 00
Fall River harbor,	235,412 00
Gloucester harbor,	494,979 67
Hingham harbor,	29,000 00
Hyannis harbor,	167,158 47
Hyannis and Nantucket harbors,	116,861 11
Ipswich River,	5,617 91
Kingston harbor,	8,940 09
Lynn harbor,	335,437 00
Malden River,	10,000 00
Manchester harbor,	23,985 57
Marblehead harbor,	833 42
Marthas Vineyard harbor,	5,000 00
Merrimac River,	366,466 72
Mystic River,	50,000 00
Mystic and Malden rivers,	240,021 10
Nantucket harbor,	349,424 12
New Bedford harbor,	167,734 64
New Bedford and Fairhaven harbors,	302,000 00
Newburyport harbor,	412,000 00
Powow River,	50,940 72
Plymouth harbor,	258,626 74
Plymouth and Provincetown harbors,	38,718 06
Provincetown harbor,	156,452 97
Rockport harbor,	22,000 00

Salem harbor,	\$63,868 66
Sandy Bay, Cape Ann harbor and breakwater, . .	1,751,229 25
Scituate harbor,	104,590 98
Taunton River,	201,950 21
Town River,	18,000 00
Vineyard Haven harbor,	55,387 35
Wareham harbor,	95,997 30
Wellfleet harbor,	11,365 57
Westport harbor,	3,000 00
Weymouth River,	60,500 00
Weymouth and Town rivers,	82,327 41
Winthrop harbor,	9,000 00
Woods Hole Channel and harbor,	306,582 68
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Total,	\$17,284,638 53

States and Territories.

Maine,	\$5,953,412 23
New Hampshire,	689,794 66
Vermont,	947,589 14
Massachusetts,	17,284,638 53
Rhode Island,	5,729,094 41
Connecticut,	5,593,802 35
New York,	41,925,351 80
New Jersey,	4,747,319 51
Pennsylvania,	10,052,095 59
Delaware,	7,261,425 00
Maryland,	9,583,836 98
District of Columbia,	383,738 98
Virginia,	8,436,718 18
West Virginia,	6,305,741 16
North Carolina,	7,457,057 80
South Carolina,	9,077,963 08
Georgia,	12,373,856 71
Florida,	11,205,058 28
Alabama,	7,624,679 72
Mississippi,	4,755,186 60
Louisiana,	6,075,855 70
Texas,	24,382,529 60
Arkansas,	3,386,118 53
Tennessee,	699,028 56
Kentucky,	4,607,074 60
Ohio,	16,211,109 78
Indiana,	1,729,760 35
Illinois,	8,525,924 81
Michigan,	43,494,495 87

Wisconsin,	\$11,493,944 17
Minnesota,	1,508,481 75
Iowa,	225,095 14
Missouri,	1,028,231 92
Kansas,	131,000 00
Nebraska,	60,000 00
North and South Dakota,	30,000 00
Montana,	25,314 61
Idaho,	87,512 87
Arizona,	9,782 77
California,	14,605,144 12
Oregon,	5,416,383 96
Washington,	4,719,052 92
Alaska,	4,950 98
Hawaii,	1,509,724 94
Porto Rico,	752,500 00
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Total,	\$328,107,378 66

HARBOR AND LAND COMMISSIONERS' TIDE WATER FUND.

It may be noted that in addition to special appropriations made by the Legislature for river and harbor work, as well as for the improvement and development of the Commonwealth's flats at South Boston, during many years previous to the passage of the Port Bill of 1911, the Board of Harbor and Land Commissioners was authorized to expend the income of the harbor compensation fund for dredging, this fund being made up from amounts received in payment for tide water displaced by structures licensed by the Board, and from receipts for rights and privileges granted in tide-water land of the Commonwealth under licenses, practically all these licenses being for wharves and other encroachments in Boston harbor. By this means the Board has been enabled in the past to carry on extensive dredging operations in this harbor, thus making it possible for deep draft vessels to reach the piers and docks from the main channel improved by the federal government, in pursuance of a long-established policy of co-operation between the State and the United States authorities.

The amount in the harbor compensation fund on Nov. 30, 1911, was \$631,513.06; the balance of income from this fund in the treasury on the same date was \$757.09; the total income for the year ending Nov. 30, 1911, was \$24,635.78. The expenditure during the year 1911, by this Board, from the income was \$53,-

765.03. The income from this fund is available for work in Boston harbor only.

Chapter 257 of the Acts of 1912 established the Harbor and Land Commissioners' Tide Water Fund, to the credit of which is to be placed all moneys received in payment for tide water displaced, and for rights and privileges granted in tide water land of the Commonwealth, and in the Commonwealth's land in great ponds under licenses and permits granted by the Board under chapter 96 of the Revised Laws. Section 2 of this act provides that the cost of supervising the transportation and dumping of material dredged in tide water under the charge and jurisdiction of this Board may, in the first instance, be paid from the fund established by this act, and shall be repaid to the Commonwealth. This act does not by its terms allow any expenditures from this fund or any income thereof, for dredging, although expenditures from the income of a similar fund, the harbor compensation fund above referred to, have hitherto been allowed and made with good results in Boston harbor.

It may be assumed that the yearly increase of this fund will be small, as it has not hitherto been the policy of the Board to charge for tide water displacement in any locality outside of Boston harbor and its tributaries, and only to a limited extent to recommend to the Governor and Council that a charge be made for rights and privileges granted in the Commonwealth's tide land in said outside locality. Therefore, if our rivers and harbors outside of Boston harbor are to be more fully developed and improved than hitherto, to meet the present and prospective demands and requirements of business, and to provide channels of approach to wharves and landings from those main channels dredged by the federal government, it is suggested that the act establishing this fund be amended, and it is recommended that this Board be authorized to expend therefrom, during the years 1913, 1914 and 1915, in such places as it may deem advisable, an amount in addition to that provided in chapter 642 of the Acts of 1912. A draft of a bill to carry this recommendation into effect has been filed.

Petitions presented during the year ending Nov. 30, 1912, under chapter 481 of the Acts of 1909, and work done in the following localities under said chapter 481 and other acts:—

ANNISQUAM RIVER.

Before improvement of Annisquam River, in Gloucester, by the Commonwealth, there were 7 feet at mean low water over the bar at the outlet of the river, and a channel, not less than 6 feet deep at mean low water, from the mouth to Wolf Hill, about $1\frac{1}{2}$ miles from Gloucester harbor at the "Cut."

For a survey and estimate of the cost of improving the channel of this river an appropriation of \$1,500 was made by chapter 71 of the Resolves of 1903. A project for improvement was prepared in accordance with a resolve passed in 1903. This project was subsequently modified and a contract was made in 1906 with the Bay State Dredging Company, providing for the dredging of a channel 50 feet wide and 6 feet deep at mean low water from Gloucester harbor to Wolf Hill, for the building of a sea wall on the easterly bank of the new channel, and for the placing of chip stone in front of the sea walls and on the banks of the canal.

During the progress of the dredging a large bowlder was removed under contract of May 24, 1907, with Thomas & Connor.

Work under both contracts was completed in July, 1907.

In 1908 the United States lighthouse authorities marked by beacons the channel dredged by the Commonwealth.

In 1909 a contract was made with Jeremiah P. O'Riorden providing for dredging to 6 feet at mean low water nearly the whole length of the channel from the Boston & Maine Railroad bridge to the Blynman or Cut bridge, and for removing two shoals north of the railroad bridge. This work and the work done in Lobster Cove, under chapter 131 of the Resolves of 1909, was completed under one contract on Nov. 5, 1909, at a total cost of \$9,700.14.

During the summer of 1911 a resurvey of the channel dredged by the Commonwealth was made. The channel had then maintained its full depth and width except for the formation of a shoal midway between the railroad and highway bridges. The shoal was formed by sand brought in from a creek, which at this point empties into the main channel. The channel dredged under the direction of the Board, as well as the natural channel to a point opposite Wheelers Point, was marked by the United States lighthouse department.

In 1912 a petition of the city improvement committee of the Gloucester Board of Trade and others, under chapter 481 of the Acts of 1909, for further improvement of this river was presented. The petitioners request the redredging of the channel to a depth of 8 feet at mean low water and the protecting of the banks of a portion of the river to prevent the falling of material into the channel. This matter is now under consideration.

A map of this river is printed with the report of the Board for 1911.

Appropriations: —

Chapter 71, Resolves of 1903,	\$1,500 00
Chapter 88, Resolves of 1904,	50,000 00
Chapter 95, Resolves of 1908,	5,381 15
Chapter 122, Resolves of 1909,	7,500 00
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Total,	\$64,381 15

Amount expended during the year, \$3.27.

Total amount expended to Dec. 1, 1912, \$83,915.40.¹

BASS RIVER, YARMOUTH.

On June 4, 1901, the Board made a report (House No. 1430) estimating the cost of the suggested improvements at Bass River, Dennis and Yarmouth, at \$22,000, and on Nov. 14, 1901, a contract was entered into with Augustus Bellevue & Co., to build two timber jetties at the river mouth and to excavate a channel between the jetties and across the flats to a depth of 4 feet at mean low water.

Other improvements were made by excavating the channel the whole distance across the flats at the entrance to the river, thus providing a channel 100 feet wide on the bottom from the deep water between the jetties through the flats to the deep water in the sound, a distance of about 1,700 feet. Subsequently the sheet piling of the jetties was protected from the action of sea worms by creosoted boards, tar paper and sand bags.

After heavy gales in September, 1904, further protective work was done under contract of Dec. 1, 1904, with Charles A. and Joseph J. Callahan, the total amount expended for this purpose during the year 1905 being \$5,084.55.

¹ This includes amount expended at Lobster Cove.

Under contract of July 14, 1909, with Connolly Bros., further repairs were made to the jetties at a total cost of \$9,999.94.

In 1910 a petition under chapter 481 of the Acts of 1909 for further improvement was presented. This petition is still pending.

In the spring of 1911 an examination was made of the jetties. It was found that the westerly one, which had not been reinforced with stone, had been badly eaten by sea worms so that the planks were practically cut off and the tide was flowing through the jetty. To preserve the jetty and to maintain the channel it was concluded to place riprap along the entire length of the westerly jetty. Under contract of March 31, 1911, with William Sears and James H. Connolly, further protective work was done at the westerly jetty at a total cost of \$5,088.88. The contract price was \$2.60 per ton for stone furnished and placed.

In May, 1912, a petition of the selectmen of the town of Yarmouth, and others, under the provisions of chapter 481 of the Acts of 1909, for further improvement of this river by dredging, was presented. Hearing was held and a survey to determine the existing conditions of a portion of the channel was ordered. No further action has been taken on this petition.

Appropriations: —

Chapter 39, Resolves of 1901,	\$500
Chapter 113, Resolves of 1901,	22,000
Chapter 46, Resolves of 1903,	15,000
Chapter 123, Resolves of 1909,	10,000
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Total,	\$47,500

Total amount expended to Dec. 1, 1912, \$52,560.60.

BEVERLY HARBOR.

On June 21, 1912, a communication from the mayor of Beverly, under the provisions of chapter 481 of the Acts of 1909, suggesting that a survey be made of Beverly harbor, was received. This matter is still pending.

BUZZARDS BAY, FALMOUTH.

On Feb. 14, 1912, a petition of the estate of John C. Haynes, and others, under the provisions of chapter 481 of the Acts of

1909, for a harbor on Buzzards Bay between Gunning Point and Hamlin Point in the town of Falmouth, was presented.

A hearing was held on this petition on Feb. 28, 1912. The particular project discussed at the hearing, namely, the excavating an entrance from Buzzards Bay to a small pond, was, after examination, found inexpedient, but a new project for a harbor is now under consideration.

CONCORD RIVER, BILLERICA.

On March 13, 1912, a petition of William J. Collins, and others, under the provisions of chapter 481 of the Acts of 1909, for the removal of rocks and certain shoals from Concord River in the town of Billerica, was presented. No conclusive action has been taken on this petition.

CUTTYHUNK HARBOR.

A survey of Cuttyhunk harbor was made in 1900, and three projects for improvement prepared, but the estimated cost of each was so large as to be practically prohibitive.

A modified plan of improvement was subsequently adopted providing for the construction of two stone jetties, one on each side of the existing harbor entrance, to confine the channel and direct it in such a manner as to force it to scour a deeper channel across the bar.

Under contract of Sept. 28, 1905, with Joseph J. Callahan, the contract price being \$1.08 per ton for stone furnished and placed, and an agreement with Alpheus Tilton to carry out the work under the Callahan contract; and under contract of Aug. 2, 1907, with Thomas & Connor, the contract price being \$2.54 per ton for stone furnished and placed, the southerly jetty, about 500 feet in length, and the northerly jetty, about 1,025 feet in length, were built.

Under contract of Dec. 10, 1909, with John R. Burke, a channel 60 feet wide on the bottom, 12 feet deep at mean low water and about 2,200 feet long, extending from the outer harbor to deep water just inside the Narrows at the entrance to Cuttyhunk Pond, was dredged, also an anchorage basin 300 feet long and 150 feet wide just inside the Narrows to the same depth, the contract price being \$15,600.

Additional dredging was also done in widening the channel at the entrance and in rounding a sharp angle near its inner end. Upon the completion of this work there was in the channel a navigable depth of 12 feet at mean low water from the sea to the wharf built by the town of Gosnold.

In 1911 and 1912 petitions were presented, under chapter 481 of the Acts of 1909, for further improvement, and under contract of April 17, 1912, with the J. S. Packard Dredging Company, the basin extension at the town landing was dredged to a depth of 12 feet at mean low water, 150 feet wide on the bottom, and 200 feet long; and the channel from the basin into the pond dredged 6 feet deep at mean low water, 60 feet wide on the bottom and 750 feet long. The contract price was \$7,400.

This work was completed June 27, 1912.

Under contract of April 17, 1912, with E. S. Belden & Sons, the outer ends of both jetties were built up and strengthened, the contract prices for furnishing stone and depositing it in place in the jetties being \$1.97 per ton; for furnishing and setting in place each iron clamp in beacon at outer ends of jetties, \$7.50. This work was completed on May 21, 1912, at a total cost of \$2,672.54.

A map of this harbor is printed in the report of the Board for 1911.

Appropriations: —

Chapter 33, Resolves of 1900,	\$1,000
Chapter 450, Acts of 1905,	5,000
Chapter 542, Acts of 1907,	7,500
Chapter 142, Resolves of 1908,	7,500
Chapter 132, Resolves of 1909,	10,000
By the town of Gosnold, 1909,	5,000

Contribution: —

Town of Gosnold, 1912,	3,000
Total,	<u>\$39,000</u>

Amount expended during the year, \$10,281.15.

Total amount expended to Dec. 1, 1912, \$46,611.17.

HERRING RIVER, HARWICH.

Under the provisions of chapter 66 of the Resolves of 1901 the Board made a survey and estimate of the advisability and cost of improving the entrance to Herring River in the town of Harwich, and of erecting barriers for the protection of the beach in that vicinity. The object of such improvement was the protection of the shore line and the providing of a harbor of refuge for small sailing craft.

A project for improvement having been finally adopted, a contract was entered into on July 27, 1905, with Thomas & Connor, to build two stone jetties, to excavate a new channel through the beach to a width of 75 feet on the bottom and to the level of mean low water, to riprap the banks of the channel and construct a dike across the old outlet of the river. The contract price was \$2.33 per ton for stone furnished and placed, and \$840 for dredging, and the work was completed in 1905 at a total cost of \$11,141.02. Subsequently a timber fence was built along the crest of the beach, and stone riprap placed to protect and secure the beach.

In 1909 a contract was entered into with William Sears and David A. Eldridge, under which the easterly jetty was extended about 200 feet, the westerly jetty about 50 feet, and the whole length of each jetty strengthened and raised with heavy quarry grout. The contract price was \$2.60 per ton for stone furnished and placed. The work was completed on Sept. 1, 1910, at a total cost of \$10,227.93.

In 1912 a petition of Louis B. F. Raycroft, and others, under the provisions of chapter 481 of the Acts of 1909, for further improvement of this river, was presented, the work desired being the dredging of a channel from the outer bar to the end of the jetties and between the jetties.

A survey was made and plans and specifications prepared. Proposals were received Aug. 14, 1912, but were subsequently rejected as, in the opinion of the Board, they were excessive. Subsequently it was concluded to combine under one contract the work of dredging at this river and at Witchmere harbor, and on Sept. 18, 1912, a contract was entered into with John R. Burke to do the work at both of these places for the sum of \$13,700. The part of the contract relating to Herring River provides for

dredging a channel to the depth of 6 feet at mean low water, from opposite Austin Eldredge's fish house to the 6-foot contour in Nantucket Sound, a distance of about 2,100 feet. The channel is to be 60 feet wide on the bottom outside of the jetties and 30 feet wide on the bottom for the remainder of its length. Work under this contract is to be completed on or before June 1, 1913.

A map of Herring River is printed with the report of the Board for 1901.

Appropriations: —

Chapter 66, Resolves of 1901,	\$500
Chapter 399, Acts of 1905,	10,000
Chapter 499, Acts of 1909,	10,000
By the town of Harwich, 1905,	2,000
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Total,	\$22,500

Amount expended during the year, \$224.92.

Total amount expended to Dec. 1, 1912, \$23,002.

HYANNISPORT.

On Dec. 27, 1911, a petition was received from James M. Pendergast, and others, under the provisions of chapter 481 of the Acts of 1909, for the construction of a jetty off Prince's Point and for certain dredging at Hyannisport in the town of Barnstable.

Hearing was held on this petition, and in May, 1912, a survey of the locality was made. Subsequently a plan and estimate of cost of building a stone breakwater were prepared.

Proposals were received Sept. 11, 1912, and on Sept. 18, 1912, it was voted to award the contract to William H. Ellis, and to execute the same when certain releases from damages and a contribution toward the cost of the work were received.

The specifications provide as follows: —

The construction of a stone breakwater extending from a point on the shore about 400 feet from Irving Avenue southeasterly about 1,150 feet, the outer portion to be 5 feet wide on top at an elevation of 4 feet above mean low water, with the sides sloping on angles of 1 on 1½, the inner portion to be 3 feet wide on top with the same slopes. At the outer end of the breakwater a beacon is to be built. At two intermediate points on the breakwater mounds of stone are to be placed to define the line of the struc-

ture. It was estimated that about 9,300 tons of stone would be required to complete this length of structure, and the specifications require its completion on or before June 1, 1913.

The contract prices are, for furnishing the stone and depositing it in place in the breakwater, \$2.40 for each ton of 2,000 pounds, and \$3.25 for furnishing and setting in place each iron clamp in the beacon at the outer end of the breakwater.

Amount expended during the year, \$44.80.

LITTLE RIVER, GLOUCESTER.

A petition of Harry C. Foster, and others, under the provisions of chapter 481 of the Acts of 1909, for a survey and estimate of cost of dredging a channel and basin in Little River, in Gloucester, was received Aug. 12, 1912. A hearing has been held and a survey ordered preliminary to preparing an estimate of the cost of the desired improvement.

LYNN HARBOR.

The dredging of an anchorage basin in Lynn harbor, outside the proposed location for Market Street extension, was authorized by chapter 110 of the Resolves of 1908, and an appropriation of \$10,000 made for the purpose. On Dec. 14, 1909, a contract was entered into with John H. Gerrish, and an anchorage basin 350 feet square was dredged on the easterly side of the channel leading to the wharf of the Peoples Coal Company, to the depth of 6 feet at mean low water, and a channel of the same depth dredged to connect the basin with the main harbor channel dredged by the United States. The contract price was 17.9 cents per cubic yard, measured in scows.

Before the completion of the work under this contract the Lynn Yacht Club requested that the dredging be extended to increase the area of the anchorage basin, and made a contribution of \$200 toward the cost of the desired work. The Board made an allotment under the provisions of chapter 481 of the Acts of 1909, to do this additional work. All work was completed July 21, 1910, at a total cost of \$12,003.28.

Chapter 501 of the Acts of 1909 directed the Board to examine Lynn harbor, the approaches thereto, the channels therein, the flats and foreshores thereof, to make surveys and to examine any plans, details and projects for the development of this harbor

submitted by the city of Lynn, and to report to the Legislature by Jan. 10, 1910. Under the provisions of the act a survey was made, plans and reports submitted by the city of Lynn were considered and the Board gave a public hearing, and made a report (House, No. 234) to the Legislature on Jan. 14, 1910.

In 1912 petitions of John H. Cogswell and others, the mayor of Lynn and others, and Fred W. Ford and others, under chapter 481 of the Acts of 1912, for further improvement of this harbor and enlargement of the anchorage basin, were presented.

By chapter 137 of the Resolves of 1912 further dredging of the anchorage basin was authorized, and an appropriation of \$20,000 made for the purpose. After conferences with city officials of Lynn and with the Metropolitan Park Commission, and after public hearings in the city of Lynn and in Boston, plans and specifications were prepared. Proposals were received on Nov. 6, 1912, and were later rejected as they were deemed excessive. It appeared, however, that the cost of dredging and depositing the material on land and flats, with suitable protection, would be greater than for dredging and depositing the material at sea. Further action is under consideration.

Appropriations: —

Chapter 110, Resolves of 1908,	\$10,000
Chapter 501, Acts of 1909,	1,000
Chapter 137, Resolves of 1912,	20,000

Contribution: —

Lynn Yacht Club, 1910,	200
	<hr/>
Total,	\$31,200

Amount expended during the year, \$199.15.

Total amount expended to Dec. 1, 1912, \$12,987.20.

MANCHESTER HARBOR.

Under contract of Oct. 18, 1907, with the Eastern Dredging Company, a channel about 1,800 feet long and 75 feet wide on the bottom was dredged in Manchester harbor to a depth of 6 feet at mean low water, at a total cost of \$7,977.84.

In 1910, 1911 and 1912 petitions under chapter 481 of the Acts of 1909 were presented for further improvement of this harbor,

and under a contract of July 26, 1911, with Jeremiah P. O'Riorden, the inner portion of the channel from the railroad bridge down stream nearly to Bow Bell Ledge was dredged, the upper portion of the channel from the railroad bridge nearly to Reed's wharf to a width of 200 feet on the bottom, and the balance to a width of not less than 100 feet on the bottom, all to a depth of 6 feet at mean low water. The contract price was 26.2 cents per cubic yard, measured in scows.

This work was completed Sept. 26, 1911, at a total cost of \$15,970.28.

Under a contract of April 17, 1912, with the Bay State Dredging Company, Ltd., the channel was dredged to the depth of 6 feet at mean low water, from the southwesterly end of the dredging done in 1911 to deep water in Massachusetts Bay. The contract price was 25½ cents per cubic yard, measured in scows, and the work was completed Oct. 16, 1912, at a total cost of \$12,925.24.

On Aug. 14, 1912, a contract was entered into with the Bay State Dredging Company, Ltd., and the width of the channel was increased about 50 feet for a distance of about 1,500 feet below the railroad bridge, and an anchorage basin, about 150 feet by 200 feet, was dredged to a depth of 6 feet at mean low water. All of this work was done between the railroad bridge and Bow Bell Ledge. The contract price was 25½ cents per cubic yard, measured in scows, and the work was completed on Nov. 8, 1912, at a total cost of \$11,846.58.

Appropriations:—

Chapter 126, Resolves of 1907,	\$8,000
By the town of Manchester, 1907,	2,500

Contributions:—

Town of Manchester, 1911,	6,000
Town of Manchester, 1912,	11,000

Total,	\$27,500
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Amount expended during the year, \$20,608.82.

Total amount expended to Dec. 1, 1912, \$44,707.68.

HAULOVER BEACH, NANTUCKET.

On Feb. 21, 1912, a petition of Benjamin Sharp, under the provisions of chapter 481 of the Acts of 1909, for examination and survey of Haulover Beach at Wauwinet in the town of Nantucket, was presented.

It is claimed by the petitioner that by making an opening or channel through this beach the distance to the fishing grounds would be greatly lessened, and that in case of heavy weather a safe harbor might be provided. At the present time the course to the fishing ground is out to and around Great Point, making the distance twice as great as by this proposed opening through the beach, and the Great Point course is too dangerous in threatening weather.

Public hearing was given on this matter on Feb. 28, 1912, and a preliminary examination of the locality has been made. No further action has been taken on this petition, but further study will be made by the Board.

NANTUCKET HARBOR.

In 1903 rocks in Nantucket harbor, dangerous to navigation, were broken up and deposited on the shore at Coatue Point, at an expense of \$1,043.50.

The improvement of this harbor by dredging in the channel between Brant Point and Hussey shoal was authorized in 1905, and under contract with the Morris & Cumings Dredging Company, in that year, an area on the northwesterly end of Hussey shoal, about 400 feet long and 300 feet wide, was dredged to a depth of 12 feet at mean low water at a cost of \$4,848.85.

On July 15, 1907, a contract was made with John H. Gerrish to dredge an area about 500 feet square, north and east of the steamboat wharf, to a depth of 12 feet at mean low water. The contract price was 27.3 cents per cubic yard, scow measurement. This work was completed Aug. 5, 1908, at a total cost of \$9,980.24.

On Jan. 24, 1912, a petition of Benjamin Sharp, and others, under chapter 481 of the Acts of 1909, for further improvement of this harbor, was presented. By chapter 696 of the Acts of 1912 an appropriation of \$10,000 by the Legislature was made available for this harbor, to be expended in dredging from the

inner end of the channel dredged by the federal government to the wharves. A survey of a portion of the harbor was made, also an examination by members of the Board, who conferred with parties in Nantucket interested in developing the facilities for navigation and in providing a sufficient anchorage basin for both large and small craft, an important consideration being accommodation for yachts of larger draft than can now readily and safely anchor in the harbor because of insufficient depth.

After careful consideration it was concluded to make an allotment of \$14,000 from the appropriation made by chapter 481 of the Acts of 1909, to be used, in connection with \$1,000 to be contributed by the town of Nantucket and the \$10,000 appropriated as aforesaid, in dredging in the vicinity of the steamboat wharf to 12 feet at mean low water, and in enlarging and deepening a portion of the present anchorage basin to 15 feet at mean low water. A contract was accordingly made Nov. 13, 1912, with Charles M. Cole, to do this dredging, the contract price being 24.3 cents per cubic yard, measured in scows. The contract provides for the excavation of 100,000 cubic yards of material, and for the completion of the work on or before Oct. 1, 1913.

Appropriations:—

Chapter 451, Acts of 1905,	\$5,000
Chapter 453, Acts of 1906,	5,000
Chapter 508, Acts of 1907,	5,000
Chapter 696, Acts of 1912,	10,000
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Total,	\$25,000

Amount expended during the year, \$341.17.

Total amount expended to Dec. 1, 1912, \$16,271.47.

ONSET BAY.

On Jan. 24, 1912, a petition of Irving C. Hammond, and others, under the provisions of chapter 481 of the Acts of 1909, for widening and deepening the channel in Onset Bay to the Cape Cod Canal, and for the dredging of a turning basin, was presented.

Hearing was held on this petition on Feb. 28, 1912, and an

inspection made by the Board. A preliminary examination was made and an approximate estimate of cost prepared, but action has been deferred pending the dredging of the approach channel to the canal in Buzzards Bay which is now nearly completed. This matter will be further considered.

Amount expended during the year, \$65.

PAMET RIVER, TRURO.

On Feb. 15, 1911, and Jan. 31, 1912, petitions of the selectmen of the town of Truro, and others, under chapter 481 of the Acts of 1909, for the improvement of Pamet River in the town of Truro, were presented. Hearings have been held on these petitions and a survey and estimate of cost of the desired improvement have been made. This matter is still pending as the large expense involved necessitates further study and modification of plans.

Amount expended during the year, \$109.27.

PLYMOUTH HARBOR.

In 1901 a shoal in the channel of Plymouth harbor near the wharf on Long Beach, which obstructed the passage of boats, was removed under contract with the Harries & Letteney Company.

The Board was directed, by chapter 95 of the Resolves of 1906, to make a survey for the purpose of determining the best method of improving the channel of this harbor leading from the main ship channel to the wharves of the Plymouth Cordage Company, and of dredging a turning basin at the inner end of the same, and to report an estimate of the cost of such improvements. A survey was made and estimates prepared. This was followed in 1907 by legislative authority directing the Board to dredge a channel from the "Cow Yard" to the wharf of said company, substantially in accordance with the plan presented in its report of 1906. The cost of this work up to the sum of \$160,000 was to be paid one-half by the Commonwealth and one-half by the town of Plymouth.

Under contract of Sept. 4, 1908, with the Eastern Dredging Company, it was provided that a portion of this channel through

the bar near the Cow Yard — about 1,100 feet in length — should be 250 feet wide and 20 feet deep at mean low water; the main portion, about 5,000 feet in length, extending from deep water back of the bar to the wharf of the Plymouth Cordage Company, was to be 150 feet wide and 18 feet deep at mean low water. The contract price was 16.7 cents per cubic yard, scow measurement, for the dredging, and \$120 each for eight oak dolphins to be constructed to mark the line of the channel. Owing to the scouring action of the current, and the consequent depositing of material in the excavated area, a portion of the channel was so often redredged as to reach nearly twice the width originally contemplated. On account of the low price at which the contract was let, this increase was secured without exceeding the original estimates. The work was completed March 22, 1911, at a total cost of \$142,339.09, of which one-half was paid by the town of Plymouth and one-half by the Commonwealth.

For the purpose of guiding the dredges in their work, seven pile dolphins were driven along the southwesterly side of the curved portion of the channel. Upon the completion of the work the harbor master of Plymouth and the Plymouth Cordage Company secured permission from the United States Lighthouse Bureau to maintain these dolphins as aids to navigation.

In July, 1912, a communication was received from the board of selectmen of the town of Plymouth, and Charles C. Doten, harbor engineer for said town, in relation to a survey of this harbor, made under authority of a recent act of Congress, and a project for the improvement of the channel to the wharves, making the same 200 feet wide and 18 feet deep at mean low water.

In November, 1912, replying to a letter on this subject from the United States engineer officer in this district, the Board expressed the opinion that if the channel leading to the wharves in this harbor is to be improved, a depth of not less than 18 feet at mean low water should be provided. Furthermore, that considering the limited amount at the disposal of the Board for harbor improvement, it was unwilling to make any allotment from the appropriation which it is authorized to expend under chapter 481 of the Acts of 1909 and chapter 642 of the Acts of 1912, for the purpose of defraying a portion of the cost of improving this harbor by the federal government in accordance with a project the cost

of which has been estimated to be \$167,000; but that it would recommend or advocate a special appropriation by the Legislature for the further improvement of this harbor in accordance with such project as might be adopted by the government, the same to be used in connection with such appropriation as might be made by Congress and as a contribution by the State of Massachusetts toward defraying a portion of the cost of carrying such a project into effect. It is suggested that action favorable to the further improvement of this harbor by the federal government be taken by the Legislature, and that an appropriation be made sufficient to pay a portion of the cost of the work, the amount so appropriated to be paid to the Secretary of War of the United States and to be expended for the improvement of this harbor in conjunction with any appropriation therefor not exceeding \$167,000 which may be made by the Congress of the United States.

On Sept. 4, 1912, a petition of the board of selectmen of Plymouth, and others, under the provisions of chapter 481 of the Acts of 1909, for widening and deepening the channel to the wharves and enlarging the basin in this harbor, was presented. No action has been taken on this petition, pending action by the United States Government.

A map of this harbor is printed with the report of the Board for 1906.

Appropriations:—

Chapter 95, Resolves of 1906,	\$400 00
Chapter 587, Acts of 1907,	20,000 00
Chapter 75, Acts of 1909,	20,000 00
Chapter 28, Acts of 1910,	25,000 00
Chapter 319, Acts of 1911,	5,000 00
Chapter 756, Acts of 1911,	1,169 55
Contributions, by the town of Plymouth and others,	71,294 54
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Total,	\$142,864 09

Total amount expended to Dec. 1, 1912, \$143,744.11.

ROCK HARBOR, ORLEANS.

A survey and estimate of cost of improving Rock harbor, in Orleans, by dredging, was made in April, 1907, and on Aug. 5, 1907, a contract for this work was made with John H. Gerrish. Upon completion of the work there was a channel 1,300 feet long,

50 feet wide on the bottom and excavated to the plane of mean low water, which, owing to the elevation of the flats outside, gave a depth of about 4 feet in the channel at low water. The inner end of this channel was enlarged to form an anchorage basin about 200 feet long and 100 feet wide. The work was completed Sept. 9, 1909, at a total cost of \$5,011.60.

In 1910 and 1912 petitions, under chapter 481 of the Acts of 1909, for the further improvement of this harbor, were presented. Hearings have been held on these petitions and a survey made, but no further action has been taken owing to the expense involved and the lack of necessary funds.

Appropriations: —							
Chapter 25, Resolves of 1907,	.	.	.	.	.	.	\$200
Chapter 116, Resolves of 1907,	.	.	.	.	.	.	5,000
							<hr/>
Total,	.	.	.	.	.	.	\$5,200

Amount expended during the year, \$189.73.

Total amount expended to Dec. 1, 1912, \$5,385.79.

SALEM HARBOR.

On May 1, 1912, a petition of J. D. Burns, and others, under the provisions of chapter 481 of the Acts of 1909, for a survey of Salem harbor, was presented.

Hearing was held on this petition on May 29, 1912, and the Board has conferred with the chairman of the Commission on the Improvement of Salem Harbor. No further action has been taken, awaiting information from the local board.

SANDWICH HARBOR.

On April 10, 1912, a petition of the selectmen of the town of Sandwich, under chapter 481 of the Acts of 1909, for the improvement of Sandwich harbor, was presented.

This petition was later considered, and it was ordered that a survey be made and an estimate of the probable cost of dredging, excavating through the beach and building jetties, prepared.

In August, 1912, the Board made personal inspection of the locality, including the dredged channel provided by the Sandwich Freezer Company for the purpose of allowing small boats

with fish to reach its buildings located about one and one-half miles from the bay.

A plan and estimates of cost of an improvement which would not only provide ready and direct access to the present channel dredged by said company, but create an anchorage basin inside the beach as a harbor of refuge have been prepared and considered by the Board, but without conclusive action owing to the lack of funds.

Amount expended during the year, \$226.44.

SAUGUS RIVER.

By chapter 27 of the Resolves of 1905 the Board was directed to make a survey of Saugus River, between the Salem turnpike and Broad Sound, and to report thereon, with estimates of the cost of dredging a channel to such depth and width as should be deemed advisable, and authorized to expend not exceeding \$1,000 therefor.

Two projects for improvement were prepared. The estimated cost of dredging a channel 12 feet deep from Broad Sound to the Salem turnpike was \$77,000. For a channel 15 feet deep from the open bay to the mouth of the river at the Point of Pines, and 12 feet the remainder of the way, the estimated cost was \$125,000. In each estimate the width of the channel was the same, 200 feet on the bottom from Point of Pines to the sea, and flaring out to about 400 feet in the last 2,000 feet, and varying above the Point of Pines from 200 to 75 feet in width.

No further appropriation was made, and no work except the survey was done at that time.

On Feb. 28, 1912, a petition of the Brett Lumber Company, and others, under the provisions of chapter 481 of the Acts of 1909, for dredging in this river between the Boston and Maine Railroad bridge and a point above Fox Hill bridge, was presented, and a hearing thereon held on March 27, 1912. Subsequently it was directed that a survey of this portion of the river be made, and the same is in progress. No final action can be taken until the completion of the Fox Hill bridge by the county commissioners of Essex County.

A map of a part of this river is printed with the report of the Board for 1905.

Appropriation:—

Chapter 27, Resolves of 1905, \$1,000

Amount expended during the year, \$362.96.

Total expenditure to Dec. 1, 1912, \$1,001.49.

SCITUATE HARBOR.

On Feb. 28, 1912, a petition of William D. Turner, and others, under chapter 481 of the Acts of 1909, for the improvement of Scituate harbor, was presented.

A survey was made and a project for improvement prepared. After a contribution of \$2,000 by the town of Scituate toward the cost of the work, a contract under date of June 5, 1912, was entered into with the Eastern Dredging Company, and the channel from the wharves to the anchorage basin, a distance of 2,100 feet, was dredged to a depth of 6 feet at mean low water, the dredged channel being at least 60 feet wide throughout its course.

In addition to the work called for by the original plan of improvement, the inner corners of the two outer angles of the channel were dredged away to facilitate the passage of larger vessels at these points. The contract price was 29½ cents per cubic yard, measured in scows, and the work was completed Aug. 24, 1912, at a total cost of \$8,975.05.

Contribution:—

By the town of Scituate, 1912, \$2,000

Total expenditure to Dec. 1, 1912, \$8,975.05.

WITCHMERE HARBOR.

Witchmere harbor, located at Harwichport, in the town of Harwich, is the home port for boats used as tenders for the light-ships stationed on the shoals near Monomoy, and is the nearest point of safe anchorage for them.

Before 1899 the local authorities had made various attempts to improve this harbor. Two wooden jetties were built at the harbor entrance, but these, while effective for a time, were soon destroyed by the combined action of storms, ice, and sea worms. A beginning had been made in the replacing of the wooden jetty on the western side of the harbor entrance by a stone jetty, but

the means at the disposal of the town were not sufficient to extend this far enough to protect the entrance effectually.

From this lack of adequate protection resulted not only a constantly increasing shoaling of the harbor, but also an unpleasant sanitary condition that required immediate attention. The Board, therefore, under the provisions of chapter 463 of the Acts of 1899, prepared and carried out a modified plan of improvement.

This plan provided for extending the stone jetty on the westerly side of the entrance about 150 feet to 200 feet, and for building a timber jetty of oak piles and spruce lumber, about 250 feet long, on the easterly side of the entrance, parallel with and 100 feet easterly of the stone jetty; the outer end of the timber jetty to be strengthened by stone riprap.

The contract prices were, for the stone jetty, \$3 per ton for stone furnished and placed, and for the timber jetty, \$1,800. Subsequently a timber bulkhead was built on the crest of the beach to prevent the driving of sand over the top of the jetty. This work was followed by dredging the entrance channel to a width of 40 feet and to a depth of 5 feet at mean low water for a length of about 1,150 feet, and the dredging of a shoal within the harbor easterly of the westerly side line of the channel. Under contract of July 20, 1906, with Thomas & Connor, the westerly stone jetty was extended and the existing jetty repaired. This last work was completed on Aug. 24, 1907, at a total cost of \$9,996.66.

Under contract of Dec. 14, 1908, with Thomas & Connor, stone riprap was placed on the banks of the entrance channel.

After these expenditures by the Commonwealth, fishermen using the channel and other citizens living in the vicinity cooperated to prevent injury to the entrance channel from the washing away of the beach at the inner end of the easterly timber jetty. To effect this protection they extended the easterly jetty into the bank, without expense to the Commonwealth.

In 1910, 1911 and 1912 petitions, under chapter 481 of the Acts of 1909, for further improvement of this harbor, were presented.

Following the building in 1911 of a concrete superstructure about 2 feet in height along the top of the jetty for a length of

260 feet, plans and specifications for further dredging were prepared, and on Sept. 18, 1912, a contract was entered into with John R. Burke for dredging this harbor and also Herring River, Harwich, the work at Witchmere harbor comprising the dredging of an entrance channel about 1,600 feet long, 60 feet wide on the bottom outside of the jetties, and 30 feet between the jetties, with an increased width in the harbor. The contract price is \$13,700 for dredging at both places, and it is provided that the work shall be completed on or before June 1, 1913.

Appropriations: —

Under chapter 96, Resolves of 1899 (which included	
East Bay and Lewis Bay),	\$84 40
Chapter 91, Resolves of 1904,	3,500 00
Chapter 441, Acts of 1906,	10,000 00
Chapter 119, Resolves of 1908,	3,000 00
By the town of Harwich, 1904,	500 00

Contribution: —

By the town of Harwich, 1912,	500 00
Total,	<u>\$17,584 40</u>

Amount expended during the year, \$202.21.

Total amount expended to Dec. 1, 1912, \$23,620.93.

WOODS HOLE, FALMOUTH.

On Feb. 21, 1912, a petition of John J. Veeder, and others, under the provisions of chapter 481 of the Acts of 1909, for dredging a channel from Woods Hole Great harbor to Eel Pond at Woods Hole in the town of Falmouth, was presented.

Hearing was held on this petition on Feb. 28, 1912, and an examination was subsequently made of the locality. No further action has been taken, but this matter will undoubtedly be brought before the Board at a later date in connection with a petition of the town of Falmouth for license to rebuild the existing bridge across this channel.

The following is a statement of work done in rivers and harbors in addition to those specified on pages 11–30, including the protection of foreshores, from 1893 to Nov. 30, 1912, inclusive: —

ALLENS HARBOR, HARWICH.

In 1908 Allens harbor at Harwichport was a shallow basin draining into Nantucket Sound through a narrow channel across a sand beach. The channel in stormy weather often filled in, and as the harbor fills from surface drainage breaks out again through the beach. Under the provisions of chapter 106 of the Resolves of 1908, a survey was made and a possible plan for improvement reported, including the excavation of a channel into the sound, the building of a jetty 200 feet long at the entrance to the channel, and the further protection of the mouth of the channel by riprap, the estimated cost being \$8,100.

As this harbor is situated only a little more than a mile from Witchmere harbor there seemed to be very little probability of its large use. No allotment has been made under chapter 481 of the Acts of 1909, and no appropriation made except for survey and examination.

A map of this harbor is printed with the report of the Board for 1908.

Appropriation: —

Under chapter 106, Resolves of 1908, \$219 50

Amount expended to Dec. 1, 1912, \$219.50.

APPONAGANSETT HARBOR.

A survey and estimate as to the advisability and cost of improving the harbor at Apponagansett, in the town of Dartmouth, was directed by chapter 38 of the Resolves of 1901. The Board reported the construction of a stone breakwater at the harbor entrance to be entirely feasible and unquestionably the best means of protection.

In 1902 and 1903, under contract with E. S. Belden & Sons, a stone breakwater 690 feet long, beginning at a point about 250 feet from the high-water line, with a width of 5 feet on top, and to an elevation of 6 feet above mean low water, was built at the harbor entrance, providing a safe anchorage for yachts

and small craft. The contract price was \$1.07 per ton for stone furnished and placed.

In 1906, under contract with E. S. Belden & Sons, this breakwater was extended, and at the completion of the work in November, 1906, its length had been increased to 830 feet, and four beacons had been built on the breakwater, one at each end and two at equal distances between. To protect the beacons from being washed down by the sea they were bound together with iron clamps. The contract price was \$1.23 per ton for stone furnished and placed.

A map of this harbor is printed with the report of the Board for 1901.

Appropriations: —	
Chapter 38, Resolves of 1901,	\$500
Chapter 509, Acts of 1902,	30,000
Chapter 443, Acts of 1906,	10,000
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Total,	\$40,500

Amount expended to Dec. 1, 1912, \$40,221.33.

BARNSTABLE HARBOR.

Under the provisions of chapter 106 of the Resolves of 1908, the Board made a survey of Barnstable harbor. The desired improvement was the dredging of a channel from deep water in the harbor to the landing in Maraspin Creek, across flats dry at low tide. A project was reported for dredging a channel 100 feet wide on the bottom and 5 feet deep at mean low water at an estimated cost of from \$22,550 to \$28,550. No work has thus far been done.

A map of this harbor is printed with the report of the Board for 1908.

Appropriation: —	
Under chapter 106, Resolves of 1908,	\$217 51

Amount expended to Dec. 1, 1912, \$217.51.

BASS RIVER, BEVERLY.

The Board was directed, by chapter 341 of the Acts of 1903, to dredge a channel in Bass River at Beverly from Danvers River to a point near Elliott Street, a distance considerably over a mile, to a depth of 18 feet at mean high water and to a width of 100 feet wherever practicable. The act made an appropriation of \$25,000 for this work, and provided that any greater expense incurred should be paid by the city of Beverly.

On Feb. 2, 1904, a contract was made with Charles H. Souther and John H. Gerrish, and a channel 6,500 feet long was dredged to a width of 100 feet on the bottom, except through the ledge in the upper portion of the river, where the width was reduced to 75 feet, and to a depth of 9 feet at mean low water. The contract price was 33½ cents per cubic yard for dredging and \$11.40 per cubic yard for excavating ledge. This dredging enabled vessels to reach the coal and lumber wharves in Beverly and the wharf of the United Shoe Machinery Company. For this work the Commonwealth expended \$25,000 and the city of Beverly \$55,535.75.

Appropriations:—

Chapter 341, Acts of 1903,	\$25,000 00
City of Beverly,	55,535 75
Total,	<hr/> \$80,535 75

Total amount expended to Dec. 1, 1912, \$81,075.56.

BUCKS CREEK, CHATHAM.

Bucks Creek is the outlet of Taylors Pond, in the southwesterly part of the town of Chatham, and is used as a harbor by a fleet of fishing boats.

The work of improvement was commenced in 1904, and a pile and timber jetty 156 feet long was built on the westerly side of the mouth of the creek, under contract of Aug. 2, 1904, with Thomas & Connor.

In 1910 and 1911 two stone jetties were built; the channel between the same was excavated to the level of mean low water, a dike across the existing channel built, and the banks of the

excavated channel protected by stone riprap, under contract of May 20, 1910, with James H. Connolly, the contract price being \$2,600 for excavating the channel and building the earth portion of the dikes, and \$2.35 per ton for furnishing and placing stone in the jetties and riprap.

A petition of Alonzo F. Cahoon, and others, under chapter 481 of the Acts of 1909, for further improvement, presented Feb. 15, 1911, is pending, no further action having been taken by reason of lack of necessary funds.

Appropriations:—

Chapter 102, Resolves of 1904,	\$1,000
Under chapter 120, Resolves of 1909 (which included Humarock Beach),	250

Contribution:—

By town of Chatham and others, 1910,	1,000
Total,	<u>\$2,250</u>

Total amount expended to Dec. 1, 1912, \$11,633.86.

CATAUMET HARBOR.

Cataumet harbor is an indentation in the easterly shore of Buzzards Bay, on the boundary line between the towns of Bourne and Falmouth. The harbor, while protected from northerly and easterly winds, is open to the southwest winds prevailing through the summer months. Only a small area partially protected by a shoal affords good summer anchorage. Leading from this harbor is a narrow and shallow channel into Squeteague Pond, affording an anchorage of $17\frac{1}{2}$ acres with a depth of 5 feet.

In 1902 the Board reported three projects for improvement: one for the dredging of an anchorage basin in the harbor itself, the other two for dredging a channel to make available the anchorage in Squeteague Pond. The cost of these projects varied from \$17,050 to \$46,530.

In the opinion of the Board, at that time, the advantages to the public of this improvement were not commensurate with the probable cost, and no work, other than a survey, was done.

A map of this harbor is printed with the report of the Board for 1902.

Total expenditure to Dec. 1, 1912, \$356.33.

CENTREVILLE RIVER.

In 1910, under the provisions of chapter 481 of the Acts of 1909, a petition for an opening through the beach opposite Bumps River, between Centreville and Osterville, in the town of Barnstable, was presented.

Bumps River is a small stream flowing into Centreville River, which in turn flows into East Bay improved under appropriations made by the Legislature. After a survey and examination of the locality it was concluded that the dredging of Centreville River would be of more benefit than the cutting through the beach requested by the petitioners, and under a contract of Sept. 28, 1910, with John H. Gerrish, a channel was dredged 5 feet deep at mean low water, 75 feet wide on the bottom, and about 2,350 feet long, from the inner end of the channel dredged by the Commonwealth in 1908 and 1909 in East Bay, through this river to a point about 200 feet southwesterly from the bridge of Thomas Gaff. The contract price was \$7,200, and the work was completed April 22, 1911.

Contribution, 1910, \$1,500

Total amount expended to Dec. 1, 1912, \$7,603.22.

COHASSET HARBOR.

In 1910 and 1911 petitions were presented, under chapter 481 of the Acts of 1909, for the improvement of Cohasset harbor.

A survey was made and a project adopted providing for a stone breakwater extending from a point on Bassing Beach about 1,200 feet northeasterly from its southwesterly end. This breakwater, about 800 feet long, was completed in October, 1911, under contract of July 18, 1910, with Thomas Fitzgibbon, the contract price being \$2.13 per ton for furnishing stone and building the structure.

Under contract of July 18, 1910, with Jeremiah P. O'Riorden, an anchorage basin and channel leading therefrom to the town landing was dredged, the anchorage basin to 6 feet at mean low water over an area about 300 feet by 1,100 feet, and the channel, in parts, to 4 feet at mean low water, 100 feet wide on the bottom and about 700 feet long. In addition, two other areas were dredged, but on account of ledges and bowlders the Board was

unable to excavate the inner end of the channel to the full depth. The contract price was $14\frac{5}{8}$ cents per cubic yard.

Under contract of May 5, 1911, with the Bay State Dredging Company, Ltd., the entrance channel and certain shoals were dredged, and the anchorage basin enlarged. By means of a contribution made by citizens of Cohasset the channel in the upper harbor was extended to the wharves at the mouth of James River, the depth of the excavation varying from 2 feet to 6 feet at mean low water. The contract price was $21\frac{9}{10}$ cents per cubic yard.

A map of this harbor is printed with the report of the Board for 1911.

Contributions:—

By the town of Cohasset, and others, . . . \$20,691 88

Amount expended during the year, \$2,123.45.

Total amount expended to Dec. 1, 1912, \$50,691.93.

CONNECTICUT RIVER.

The Board was authorized and directed, by chapter 58 of the Resolves of 1884, "to examine the channel and course of the Connecticut River within the confines of this Commonwealth, and to investigate the cause and effect of floods upon the same, and to report to the next General Court the necessity or expediency of any legislation for the preservation and improvement of said river, and for the promotion of all interests connected therewith."

After public hearings in Northampton and Boston and an examination of various localities on the river, the Board made a report to the Legislature embodying certain recommendations. It was stated, however, that in its opinion no work should be undertaken until scientific surveys and observations of the river and river conditions had been made.

In the following year, by chapter 344 of the Acts of 1885, the Board was given, over the Connecticut River within the confines of the State, jurisdiction similar to that exercised over tide waters. Immediately following the passage of this act petitions and requests were made to both the Board and the Legislature for the protection of the river banks which were being worn by the action of the waves and current.

The town of Hadley had suffered greatly from the encroachments of this river. After numerous unsuccessful attempts to protect the river banks the town appealed for assistance to the Legislature. In 1888, by chapter 95 of the acts of that year, an appropriation of \$15,000 was made for protective work at Hadley.

The methods of protection begun in Hadley, under authority of this act, are the same that have been continued under other appropriations and employed in other localities along the river. The bank below the water line was protected by mats. These mats were woven of willow brush on frames made by poles wired at right angles. Upon completion the mats were loaded with rubble stone and sunk below water to the bed of the river. Above the water line the banks were first graded then covered with mats and the whole overlaid with riprap. Later the upper banks were planted with young willows.

Under different appropriations, protective work of this character has been carried on at Hadley, Agawam, West Springfield and Northampton. In addition, dikes have been built at Hatfield and Hadley, where special conditions demanded that form of protection. The appropriations and expenditures in these localities from 1888 to 1912, inclusive, have been:—

LOCALITY.	Total Appropriation.	Total Expenditure.
Agawam,	\$13,000 00	\$11,430 19
Hadley,	68,000 00	78,801 54
Hatfield,	7,500 00	6,700 75
Northampton,	1,500 00	1,524 20
West Springfield,	5,000 00	5,051 49
Total,	\$95,000 00	\$103,508 17

In 1897 the Board, in compliance with the provisions of chapter 82 of the Resolves of that year, inquired into the advantages which would accrue to this Commonwealth by the improvement of the navigation of this river as far as the cities of Springfield and Holyoke, and reported thereon. (House, No. 907, of 1907.)

By chapter 149 of the Resolves of 1912 the Connecticut Valley Waterway Board was established, the chairman of that Board

being the chairman of the Board of Harbor and Land Commissioners.

It is the duty of this special Board to investigate the subject of the improvement of this river for the purposes of navigation, and to report to the General Court not later than Feb. 1, 1913.

In addition to the above, other appropriations were made as follows:—

Investigation of navigation, 1896-98,	\$5,500
Holyoke, dredging, ¹	15,000
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Total,	\$20,500

Total appropriations, \$115,500.

Total expenditure to Dec. 1, 1912, \$106,296.18.

COTUIT HARBOR.

From a survey and examination of Cotuit harbor, made in June, 1904, it appeared that the channel across the bar at the entrance was obstructed by both stones and bowlders.

Subsequently a contract was entered into with Ruggles & Perkins to remove these obstructions and to make a fair way about 400 feet wide. This work was completed Oct. 3, 1904, at a total cost of \$1,837.

In 1910 a petition, under chapter 481 of the Acts of 1909, for further improvement of the harbor entrance, was presented, and on July 25, 1910, a contract was entered into with the Bay State Dredging Company, and a channel across the bars at the entrance to the harbor was dredged to a width of 200 feet on the bottom and to a depth of 6 feet at mean low water, the entrance channel being in two sections, the inner one about 700 feet long and the outer one 3,000 feet, the basin between the two sections being about 1,000 feet across, with a depth of from 6 feet to 10 feet at mean low water. The contract price was \$22,500. This work was completed Jan. 1, 1911, at a total cost of \$23,199.13.

Subsequently two shoals or bars in the channel near Bluff or Codmans Point were dredged at a cost of \$4,166.61, making the total cost of the whole improvement \$27,365.74.

A survey of the outer entrance channel made in October, 1911, showed that up to that time the channel had maintained its full width and depth.

¹ No expenditure has been made from this appropriation.

A map of this harbor is printed with the report of the Board for 1911.

Appropriations:—

Chapter 358, Acts of 1904,	\$5,000
Chapter 546, Acts of 1908,	5,000
Chapter 124, Resolves of 1909,	10,000

Contribution:—

By citizens of Cotuit, 1910,	2,000
Total,	<u>\$22,000</u>

Total amount expended to Dec. 1, 1912, \$30,443.74.

DEACONS POND HARBOR, FALMOUTH.

In 1908 a contract was entered into, with John R. Burke, to build two jetties and to dredge in Deacons Pond harbor. Under this contract two stone jetties were built at the outer end of the entrance channel, a channel from the sound into the pond dredged to a depth of 7 feet at mean low water, 150 feet wide on the bottom, and an anchorage basin dredged to a depth of 7 feet at mean low water over an area of about 4 acres.

In October, 1909, a small additional amount of stone was placed on the westerly jetty where a slight settlement had occurred. At the end of the fiscal year, 1909, the total expenditure at this harbor was \$35,007.

In 1910 two petitions, under chapter 481 of the Acts of 1909, for further improvement, were presented. Subsequently under a contract with John R. Burke, dated April 5, 1911, a shoal, 400 feet long and 50 feet wide, was removed, and the anchorage basin was extended over an area about 350 feet long and 350 feet wide, northeasterly of and adjoining the area dredged in 1909, all dredging being to a depth of 7 feet at mean low water. The contract price was 25.9 cents per cubic yard.

In 1912 stone to the amount of 166.2 tons was placed in the outer end of the west jetty, under agreements with E. S. Belden & Sons, at a cost of \$400.

A map of this harbor is printed with the report of the Board for 1911.

Appropriations: —

Chapter 461, Acts of 1906,	\$15,000
Chapter 8, Acts of 1907,	10,000
Town of Falmouth, 1909,	10,000

Contribution: —

Town of Falmouth, 1911,	2,000
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Total,	<u>\$37,000</u>
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Amount expended during the year, \$410.

Total amount expended to Dec. 1, 1912, \$45,557.61.

EAST BAY, OSTERVILLE.

Between 1899 and 1903, surveys and investigations were made for the purpose of ascertaining the feasibility and cost of opening a new channel for the passage of boats from Nantucket Sound into East Bay at Osterville in the town of Barnstable, and under contract of Dec. 29, 1903, with Samuel N. Ames, Joseph P. Hallet and Jehiel R. Crosby, jetties were built and a channel dredged through the beach into the sound, the existing outlet being closed by a dam. The work was completed in May, 1904. Subsequently damages to the shore and to the dam caused by the sea were repaired, followed, in 1908, by dredging a channel to a width of 150 feet and a depth of 4 feet at mean low water from the channel between the jetties into deep water on the northerly side of the bay, and a channel 100 feet wide between the jetties and 4 feet deep at mean low water into the sound. This work was completed June 9, 1909, the contract price being \$7,000. Further repair work to the beach near the entrance channel was done under contract of Dec. 16, 1908, with Connolly Bros., the contract price being \$2.40 per ton.

In October, 1909, further dredging was done in order to enable boats to approach the public landing in the bay at all stages of the tide, a channel 200 feet long, 50 feet wide and about 4 feet deep at mean low water being dredged from deep water towards the shore at this landing.

In 1911 a contract was made with E. S. Belden & Sons, under which the westerly jetty was extended seaward 100 feet and its outer end built up, 1,406.64 tons of stone being placed. The

contract prices were \$2.73 per ton for stone furnished and placed, and \$11 each for the iron clamps.

A map of this Bay is printed with the report of the Board for 1911.

Appropriations:—

Under chapter 96, Resolves of 1899 (which included	
Witchmere harbor and Lewis Bay),	\$438 39
Chapter 376, Acts of 1903,	6,500 00
Chapter 115, Resolves of 1908,	10,000 00
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Total,	\$16,938 39

Total amount expended to Dec. 1, 1912, \$22,937.54.

ESSEX RIVER.

By chapter 125 of the Resolves of 1908 the sum of \$5,000 was appropriated for the improvement of Essex River to be used in connection with one of a like amount by the United States government. The money appropriated by the Commonwealth was paid to the Secretary of War and the improvement carried out by the United States engineers.

GREEN HARBOR.

In 1896 this Board and the State Board of Health were constituted a Joint Board to investigate and report on conditions at Green harbor, in the town of Marshfield. A report with certain recommendations for improvement was made in January, 1898, and to carry out the same an appropriation of \$67,000 was made by chapter 469 of the Acts of 1898. This amount was to be used for the improvement of this harbor below the dike by excavating an anchorage basin within the point of Duxbury Beach, by opening a channel from the basin to the sea, and by protecting the entrance to the channel by stone jetties.

Two stone jetties were built under contract of Sept. 27, 1898, with the Rockport Granite Company of Massachusetts at a cost of \$33,256.93. A timber wall to direct the current of Cut River was completed in February, 1900.

The dredging of a channel between the jetties to a depth of 5 feet at mean low water and to a width of 60 feet on the bottom,

also an anchorage basin about 350 feet by 300 feet to the same depth as the channel, were completed in 1900. The total cost of this work was \$26,073.79.

For additional dredging an appropriation of \$10,000 was made by chapter 393 of the Acts of 1904. After an examination of the conditions the Board concluded that any further expenditure for dredging was inexpedient unless the jetties were first repaired and built up. No expenditure was therefore made from this appropriation.

By chapter 585 of the Acts of 1908 this Board and the State Board of Health were again constituted a Joint Board to investigate and report on conditions at this harbor. A report was submitted in March, 1909, in which were outlined three possible plans for improvement at estimated costs varying from \$67,500 to \$158,900. The Joint Board, however, stated directly that it made no recommendation as to the expediency of making the expenditures necessary to carry out these improvements.

Appropriations: —

Chapter 495, Acts of 1896,	\$12,000
Chapter 556, Acts of 1898,	30,000
Chapter 447, Acts of 1899,	37,000
Chapter 393, Acts of 1904,	10,000
Chapter 657, Acts of 1908,	1,500
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Total,	\$90,500

Total expenditure to Dec. 1, 1912, \$76,333.26.

HARBOR COVE.

In 1911 a petition under chapter 481 of the Acts of 1909, for the improvement of Harbor Cove, Gloucester harbor, was presented. In August and September of the same year a survey was made, and an estimate subsequently prepared of the cost of improvement.

While this matter was still under consideration, the Legislature, by chapter 110 of the Resolves of 1912, appropriated \$20,000 for the improvement of this locality, and under this authority a contract was entered into on June 14, 1912, with Jeremiah P. O'Riorden, for dredging to a depth of 15 feet at mean low water, and for the removal of ledge estimated to contain about 50

cubic yards. The dredging was substantially completed in August, 1912, but it will be necessary to remove certain ledge uncovered by the dredging before the full depth of 15 feet can be obtained over the whole area covered by this contract. The contract prices were \$9,600 for dredging and \$12 per cubic yard for the removal of ledge.

Appropriation: —

Chapter 110, Resolves of 1912, \$20,000

Amount expended during the year, \$8,792.05.

Total amount expended to Dec. 1, 1912, \$8,971.62.

HERRING RIVER DIKE, WELLFLEET.

The construction of a dike at or near the mouth of Herring River, in Wellfleet, was authorized in 1907.

In 1908 a contract was made with Thomas & Connor to do this work for the sum of \$16,250. The dike was closed on Sept. 20, 1909. Subsequently a leak developed under the southerly sluice box, and settlement occurred in the filling under all the sluices. All work was completed May 24, 1910, and in October, 1910, the town of Wellfleet was notified that the dike and fishway were completed and that the town was authorized to maintain and operate the same, as provided in chapter 511 of the Acts of 1907.

Appropriations: —

Chapter 511, Acts of 1907, \$10,000

By the town of Wellfleet, 1908, 10,000

Total, \$20,000

Amount expended during the year, \$985.44.

Total amount expended to Dec. 1, 1912, \$21,800.73.

HULL SEA WALL.

By chapter 701 of the Acts of 1912 the Board was authorized and directed to build such a breakwater, retaining wall, sea wall or other structure in the town of Hull as is deemed necessary for the protection from encroachment or damage by the sea of the outer Boston harbor shore extending from Gun Rock to a point near the westerly end of Green Hill, and authorized to ex-

pend for this purpose not exceeding \$25,000. It was further provided that the Board should not begin the work until the shore owners released to the Commonwealth all claims for damages which they might have on account of said work. This act was approved June 1, 1912.

In July, 1912, a survey was made, and subsequently plans for a concrete sea wall and an estimate of cost were prepared. The work was advertised and proposals received Aug. 28, 1912. The required releases were filed Oct. 2, 1912, and on that date a contract was entered into with William Sears and James H. Connolly, the specifications providing for a wall about 2,587 feet in length and 20 spur jetties, each 25 feet long, to be built between Gun Rock and Green Hill, the wall to be of varying sizes as follows: 100 linear feet 8 feet high; 325 linear feet 9 feet high; 550 linear feet 10 feet high; 425 linear feet 11 feet high; 1,187 linear feet 12 feet high. The width of the top of the wall is to be 2 feet 6 inches, the width of the bottom and the slope of the face and back of the wall to vary with the height and type shown on the contract plan. The spur jetties are to be 5 feet high, 2 feet wide on the top and 3 feet wide on the bottom. The top of the main wall is to be 21 feet above the level of mean low water. It was estimated that about 3,800 cubic yards of concrete would be required to complete the work. The contract price is \$5.60 for each cubic yard of concrete measured in place, and by the terms of the contract all work is to be completed not later than July 1, 1913. No work has been done.

Appropriation: —

Chapter 701, Acts of 1912,	\$25,000
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Amount expended during the year, \$381.06.

HUMAROCK BEACH, SCITUATE.

By chapter 120 of the Resolves of 1909 the Board was directed to investigate the cost and practicability of building a sea wall at Humarock Beach, Scituate. An examination and survey of the locality was accordingly made.

This beach is located near the old mouth of North River, and is a narrow ridge of sand about 1,000 feet across. The portion for which protection was desired lies opposite the bridge and ex-

tends about 2,000 feet north and 1,500 feet south of Sea Street. The estimated cost of this improvement was \$24,600. No work in addition to the survey has been done.

Amount expended to Dec. 1, 1912, \$236.07.

IPSWICH RIVER.

A survey of Ipswich River was made in July, 1906, and a project prepared for such improvement as the limited appropriation permitted.

Under contract of Sept. 7, 1906, with Jeremiah P. O'Riorden, it was provided that channels be dredged as follows: (1) at the inner bar at the mouth of the river, 600 feet long, 100 feet wide on the bottom and 6 feet deep at mean low water; (2) opposite the mouth of Neck Creek, 500 feet long, 60 feet wide on the bottom and 5 feet deep at mean low water; (3) from Horseshoe Curve to the southerly end of Old Maid's bank, about 1,900 feet long, generally 60 feet wide on the bottom and 5 feet deep at mean low water. The contract price was $28\frac{9}{10}$ cents per cubic yard, measured in scows.

Work under this contract was completed June 29, 1907, at a total cost of \$5,193.42. The channel at the inner bar and opposite Neck Creek was completed, and the channel through the bar near Horseshoe Curve was dredged as far as the appropriation allowed.

Under contract of Sept. 9, 1907, with John H. Gerrish, the remainder of the channel through the shoal between Horseshoe Curve and Old Maid's bank was dredged 60 feet wide on the bottom and 5 feet deep at mean low water. The work was finished Oct. 29, 1907, at a total cost of \$2,999.84, the contract price being 34 cents per cubic yard measured in scows.

The improvement of the river as originally planned by the Board was still incomplete at the close of the year 1907. Under contract of July 20, 1908, with the Bay State Dredging Company, the channel of the river was widened by dredging the southerly bank opposite Barras Banks for a length of 500 feet, to a width of 60 feet on the bottom and to a depth of 5 feet at mean low water. The contract price was 45 cents per cubic yard, measured in scows. The work was finished Aug. 8, 1908, at a total cost of \$2,995.30.

In 1910 a petition, under the provisions of chapter 481 of the Acts of 1909, for further improvement of this river, was presented. In 1911 a project was adopted for building a stone jetty on the southwesterly side of the river mouth, and on April 14, 1911, a contract was made with Thomas Fitzgibbon for building this jetty, extending from the shore a distance of about 160 feet below high water mark. The contract price is \$2.43 per ton for stone furnished and placed. Only a portion of the work has been done.

Appropriations: —

Chapter 473, Acts of 1906,	\$5,000
Chapter 509, Acts of 1907,	3,000
Chapter 101, Resolves of 1908,	3,000

Contribution: —

Town of Ipswich, 1911,	1,000
Total,	<u>\$12,000</u>

Amount expended during the year, \$1,646.13.

Total amount expended to Dec. 1, 1912, \$14,829.20.

LAKE ANTHONY.

Lake Anthony is a body of water with an area of about 35 acres, situated in the town of Oak Bluffs. Before improvement it was connected with Vineyard Sound by a narrow outlet almost completely closed by sand driven into it by the sea. At its southern end was an area of about 14 acres, with a depth of over 5 feet at mean low water. To cut a channel between this deep water area and the sound to afford a passage for boats and vessels of not less than 5 feet draft, and to deepen the lake, if necessary, to serve as a boat harbor, were the improvements authorized by the Legislature in 1898.

Under contract of Aug. 15, 1899, with the Bay State Dredging Company, an excavation was made through the beach 100 feet wide on the bottom and 5 feet deep at mean low water, the contract price being \$6,000. The entrance channel was protected by two stone jetties built under contract of July 5, 1899, with E. S. Belden & Sons, the contract price being \$2.23 per ton. These jetties extended from the top of the beach into the sound about 200 feet beyond the low water line, reaching a depth of about 8 feet at mean low water. Work under both contracts was com-

pleted by November, 1899. Subsequently the jetties and the cut were repaired.

After consideration of the situation, the Board decided to expend the appropriation of \$5,000, made by chapter 399 of the Acts of 1901, in dredging an approach to the landing wharf and in placing ten heavy moorings in the harbor. In 1901, under a contract with George H. Cavanagh, an approach to the landing wharf was dredged, moorings placed, and shoal places in the entrance channel dredged. The moorings were set early in the season and the work entirely completed by Oct. 21, 1901, at a total cost of \$2,863.51.

The United States Lighthouse Department, during 1901, placed two lights at the ends of the jetties. These lights were placed within an area 10 feet in diameter in the center of the head of each jetty, this area having been conveyed by request to the United States under the provisions of section 7 of chapter 1 of the Public Statutes.

Further improvements have been the enlargement of the anchorage basin, the closing with concrete of the spaces between the stones in the jetties, and the removal of a large boulder just beyond the outer end of the wharf on the northwesterly side of the lake. This work was followed by further dredging the channel and anchorage basin.

Under contract of July 29, 1904, with John H. Gerrish, the entrance was deepened to 7 feet at mean low water for a width of 75 feet through the center, and the anchorage basin deepened to 6 feet at mean low water and increased in area by $7\frac{1}{2}$ acres. This work was completed in December, 1904.

In 1910 a petition under chapter 481 of the Acts of 1909 for further improvement of this harbor was presented, and on March 31, 1911, a contract was made with John H. Gerrish which provided for strengthening the jetties, dredging the harbor, and protecting the outer and inner ends of the jetties by granite quarry grout and stone riprap. It was also provided that the entrance channel be dredged from the outer end of the jetties westerly 400 feet, to a width of 100 feet on the bottom, to a depth of not less than 7 feet at mean low water, and shoals in the anchorage basin removed. The work was completed Dec. 13, 1911.

A map of this harbor is printed with the report of the Board for 1911.

Appropriations: —

Chapter 441, Acts of 1898,	\$5,000
Chapter 155, Acts of 1899,	15,000
Chapter 399, Acts of 1901,	5,000
Chapter 416, Acts of 1904,	10,000

Contribution: —

Town of Oak Bluffs, 1911,	2,000
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Total,	<u>\$37,000</u>
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Amount expended during the year, \$2,747.65.

Total expenditure to Dec. 1, 1912, \$46,944.59.

LEWIS BAY.

Lewis Bay, in the towns of Barnstable and Yarmouth, was surveyed and examined by the Board in 1899, under authority of chapter 96 of the Resolves of that year. Plans for the improvement of this bay and estimates of cost were prepared.

Under contract of May 17, 1900, with Cole Bros., the channel leading to the wharves in the inner bay was dredged to 6 feet at mean low water, the work being completed in November, 1900, thus providing from the sound to these wharves a channel 6 feet deep at mean low water, 150 feet wide in the upper, and 200 feet wide in the outer, portion. The contract price was 37½ cents per cubic yard, measured in scows.

In 1905 a channel was dredged across the bar in the eastern end of the bay, under contract of August 2 of that year, with the Bay State Dredging Company. This work was finished Dec. 5, 1905.

A map of this Bay is printed with the report of the Board for 1899.

Appropriations: —

Under chapter 96, Resolves of 1899 (which included Witchmere harbor and East Bay),	\$977 21
Chapter 194, Acts of 1900,	12,500 00
Chapter 395, Acts of 1905,	3,000 00

Total,	<u>\$16,477 21</u>
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Amount expended to Dec. 1, 1912, \$17,012.22.

LOBSTER COVE.

Lobster Cove is a tributary of Annisquam River, in Gloucester. By means of an appropriation made in 1909 a channel was dredged 50 feet wide on the bottom and 6 feet deep at mean low water in this cove, from the channel of Annisquam River near the Annisquam Yacht club house to a point opposite Fish Market wharf.

In 1910 a petition, under chapter 481 of the Acts of 1909, for further improvement was presented; and on Nov 18, 1910, a contract was made with J. P. O'Riorden, under which an anchorage basin 268,000 square feet in area was dredged. The channel, 500 feet in length, connecting the anchorage basin with the main channel of Annisquam River, was widened, and both channel and anchorage basin excavated to a depth of 6 feet at mean low water. This work was completed July 14, 1911.

Appropriation: —	
Chapter 131, Resolves of 1909,	\$2,500
Contribution: —	
City of Gloucester, 1910,	1,500
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Total,	\$4,000

The expenditures for Lobster Cove are included under Annisquam River.

MENAMSHA INLET.

Menamsha Inlet, on the island of Marthas Vineyard in the towns of Gay Head and Chilmark, is a harbor of refuge for fishermen and light craft generally. The improvement of this harbor was begun under authority of chapter 323 of the Acts of 1897. This act authorized the Board to close the existing outlet of Menamsha Pond, to excavate a new outlet on the boundary line between Gay Head and Chilmark, and to build on the banks of the new outlet and extending into Vineyard Sound protective works for the purpose of fixing the location of the new outlet and thus marking the boundary line.

Under additional appropriations made in 1898, 1899 and 1903, stone and timber jetties were built at the entrance, and a channel 75 feet wide and 5 feet deep at mean low water dredged straight through the flats to the existing channel opposite the road to Vineyard Haven. The banks of the new channel were partially

protected by stone riprap. The total expenditure through these years was \$20,379.18.

In 1906 a contract was made with George H. Cavanagh for strengthening the jetties with stone, for excavating the channel and anchorage basin, and for protecting the banks of the anchorage basin and channel with stone riprap. The work was completed so far as the appropriation allowed on June 22, 1908.

In November, 1908, a conveyance was made to the United States government of two tracts of land lying under the outer ends of the two jetties built by the Commonwealth, together with a right of way over land of the Commonwealth to the tracts conveyed. Upon the jetties have been erected by the United States government beacon lights as aids to navigation.

In 1910, under chapter 481 of the Acts of 1909, a petition of Daniel H. Flanders, and others, for further improvement, was presented, and a survey made in March, 1910. A project was prepared and subsequently the channel was dredged to a width of 75 feet on the bottom, and to a depth of 6 feet at mean low water, from Vineyard Sound southeasterly for a distance of about 1,500 feet. At the inner end of the channel a basin 200 feet long and 150 feet wide was dredged to the same depth. The westerly portion of the basin just inside the jetties was redredged to a depth of 6 feet at mean low water. The outer ends of the jetties were strengthened with granite quarry grout, and an embankment about 200 feet in length, of sand protected by riprap, was built on the easterly side of the channel as a training wall. This work was done under contract of June 3, 1910, with the Eastern Dredging Company. In addition a channel 50 feet wide and 600 feet long was dredged from the easterly end of the anchorage basin to the beginning of the bluff on which the Tilton House stands, and about 100 tons of riprap on the easterly side of the main channel was removed from the space where the proposed training wall was to be built, and afterwards placed as riprap on the banks of the training wall.

All work was completed Sept. 10, 1910, at a total cost of \$11,697.08.

From an examination made during the year 1912 it was found that the bulkhead previously built along the crest of the beach north of the entrance channel had been damaged by storms, and

that at times of extreme high tides some material had been washed into the basin previously dredged. Arrangements have been made for making the necessary repairs and some additions to this structure.

Appropriations: —

Chapter 323, Acts of 1897,	\$2,000
Chapter 357, Acts of 1898,	2,000
Chapter 133, Acts of 1899,	5,000
Chapter 394, Acts of 1903,	10,000
Chapter 90, Resolves of 1906,	25,000

Contribution: —

Town of Chilmark, 1910,	700
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Total,	<u>\$44,700</u>
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Amount expended during the year, \$10.30.

Total amount expended to Dec. 1, 1912, \$57,380.68.

MERRIMAC RIVER.

In 1902, in response to an order of the Legislature, this Board reported on the feasibility and advisability of opening the Merrimac River to navigation from Lowell to the sea.

In accordance with the provisions of chapter 63 of the Resolves of 1907, the Board reported to the General Court in regard to the construction of a safeguard to be placed in this river at Lawrence, immediately above the dam of the Essex Company, in order to prevent boats and persons from being carried over the dam. This report, House No. 1463, was made May 17, 1907.

By chapter 708 of the Acts of 1912 the Merrimac Valley Waterway Board was established, one of the members, the chairman of that Board, being a member of the Board of Harbor and Land Commissioners. It is the duty of this special Board to make a thorough investigation with relation to the development of navigation and power in and along this river, and to make report to the General Court not later than Feb. 1, 1913.

MILL RIVER, GLOUCESTER.

The tidal portion of Mill River, a tributary of Annisquam River, extends from the end of Wheeler's Point to the mills at Riverdale, a distance of about 1 mile. At the mouth of the river, before im-

provement, a bar existed, covered at mean low tide by about 2 feet of water. Above the bar there was a narrow winding channel varying in depth from 3 to 6 feet at mean low water.

In 1910 and 1911 petitions, under chapter 481 of the Acts of 1909, for improvement were presented.

A survey was made in August, 1911, and an estimate prepared of the cost of dredging a channel 50 feet wide on the bottom and 6 feet deep at mean low water. Before decisive action on the above petitions had been taken the Legislature, by chapter 138 of the Resolves of 1912, appropriated \$5,000 for the improvement of this river. As this sum was, according to the previous estimates of the Board, quite insufficient for the work required, an allotment of \$10,000 was made from the general appropriation under chapter 481 of the Acts of 1909, to be used in connection with the special legislative appropriation.

On July 24, 1912, a contract was entered into with the Bay State Dredging Company, Ltd., for dredging a channel and anchorage basin to a depth of 6 feet at mean low water, the channel to be 3,400 feet long and 60 feet wide on the bottom, and the anchorage basin to cover an area of about 34,500 square feet. The contract price was \$14,500. All of the dredging was completed on Nov. 9, 1912, but during the progress of the work, bowlders too large to be removed by the dredge were uncovered, as was also a portion of ledge near the middle of the channel a short distance north of the last turn off Riverdale over which there is a depth at mean low water of about 4 feet. Bowlders were removed at a cost of \$250. This ledge will be removed to a depth of 6 feet at mean low water under another contract.

Appropriation:—

Chapter 138, Resolves of 1912, \$5,000

Amount expended during the year, \$12,605.66.

Total amount expended to Dec. 1, 1912, \$13,051.01.

NORTH RIVER.

The navigable portion of North River extends from North River bridge at Hanover to the sea, a distance of about 12 miles. Before improvement the channel for about two-thirds of this distance was

obstructed by bowlders, and at one point, near the village of Norwell, by a ledge extending across the river.

In 1910 petitions under chapter 481 of the Acts of 1909, for the removal of rocks and obstructions, were presented, and on April 14, 1911, a contract was made with Thomas Fitzgibbon for the removal of bowlders from this river. Work under this contract was completed Oct. 13, 1911, at which time the channel had been cleared of bowlders for a width of not less than 100 feet the whole distance from the landing at Hanover to the sea. The contract price was \$2.83 per ton for removing the bowlders and disposing of the same. The total cost of the work was \$4,879.61.

Appropriation:—

Under chapter 106, Resolves of 1908,	\$119 70
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Contributions:—

Town of Norwell, 1911,	500 00
Town of Marshfield, 1911,	500 00
Town of Pembroke, 1911,	300 00
Town of Hanover, 1911,	500 00

Total,	\$1,919 70
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Amount expended during the year, \$1,059.73.

Total amount expended to Dec. 1, 1912, \$5,432.08.

OAK BLUFFS.

In 1908, under authority of chapter 104 of the Resolves of that year, certain rocks near the outer end of a public pier at Oak Bluffs, which obstructed the approach of boats thereto, were removed at a cost of \$462.50.

Appropriation:—

Chapter 104, Resolves of 1908,	\$500
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Total expenditure to Dec. 1, 1912, \$462.50.

PASKAMANSETT RIVER.

Paskamansett River empties into a cove on the westerly side of Buzzards Bay, between Mishaum Point and Barneys Joy Point. Before improvement by the Commonwealth the river channel was from 5 feet to 10 feet deep at mean low water, but the river mouth

was obstructed by a bar over which there was less than 3 feet at low tide.

On Aug. 2, 1905, a contract was made with the Bay State Dredging Company which provided for the dredging of a channel 150 feet wide, 5 feet deep at mean low water, and about 400 feet long through the bar at the mouth of the river. The work was finished on May 12, 1906, at a cost of \$2,000.

In 1910 a petition, under chapter 481 of the Acts of 1909, for the further improvement of this river, was presented. Hearing has been held on this petition, but no further action has been taken, owing to lack of funds.

Appropriation: —

Chapter 449, Acts of 1905,	\$2,000
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Total amount expended to Dec. 1, 1912, \$2,187.35.

PENIKESSE ISLAND.

By chapter 118 of the Resolves of 1908 the Board was authorized and directed to build a pile wharf at Penikese Island in Buzzards Bay, in extension of the present stone wharf on the easterly side of the main part of the island. The work, consisting of a pile wharf 200 feet long, 20 feet wide, with an ell at the outer end 42 feet by 30 feet, was done under contract of Aug. 3, 1908, with the Cahill Construction Company, and was completed Jan. 2, 1909. After its completion the wharf was turned over to the State Board of Charity as required by the above resolve.

The Board was directed, by chapter 93 of the Resolves of 1909, to make a survey of the entrance to Penikese Island and a report with estimate of cost of dredging a channel not less than 150 feet wide and 12 feet deep at mean low water from the wharf built by the Commonwealth to the channel between Cuttyhunk and Penikese islands. This survey was made, and an estimate of \$15,000 submitted in the report of that year as the cost of the desired dredging.

Appropriations: —

Chapter 118, Resolves of 1908,	\$5,000
Chapter 93, Resolves of 1909,	300

Total,	\$5,300
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Total expenditure to Dec. 1, 1912, \$5,192.95.

PLUM ISLAND RIVER.

Plum Island River is a narrow channel or strait in Newbury and Newburyport, connecting the head of Plum Island Sound with the Merrimac River near its mouth.

Under authority of chapter 106 of the Resolves of 1908 a survey was made, and it was reported that a channel could be dredged to a width of 50 feet on the bottom and to a depth of 5 feet at mean low water for a distance of about $3\frac{7}{8}$ miles at an estimated cost of \$150,000.

No further appropriation has been made and no work undertaken.

A map of this River is printed with the report of the Board for 1908.

Appropriation:—

Under chapter 106, Resolves of 1908, \$983 31

Total expenditure to Dec. 1, 1912, \$983.31.

QUANSETT HARBOR, ORLEANS.

Quansett harbor is a small cove or basin on the northerly shore of Pleasant Bay, between the towns of Orleans and Chatham. The harbor is oval, about 800 feet long and 400 feet wide, with an entrance about 130 feet wide between low water lines. The channel from Pleasant Bay through the entrance to deep water in the basin is only about 1 foot deep at mean low water.

Under authority of chapter 106 of the Resolves of 1908 a survey was made and an estimate of the cost of improvement prepared. The work desired was the dredging of a channel through the harbor entrance to connect deep water in the bay with deep water in the harbor. The cost of this project was estimated at \$6,600. No further appropriation has been made and no work undertaken.

A map of this harbor is printed with the report of the Board for 1908.

Appropriation:—

Under chapter 106, Resolves of 1908, \$195 88

Total expenditure to Dec. 1, 1912, \$194.50.

QUICKS HOLE.

In pursuance of the requirements of chapter 25 of the Resolves of 1903 a preliminary examination was made as to the expediency of constructing a harbor of refuge for fishing boats and small yachts on the westerly side of Quicks Hole in the town of Gosnold by excavating a channel into the pond at the northwesterly end of Nashawena Island.

After examination and a consideration of the conditions it was reported that it was not deemed expedient to make either a survey or estimate of cost of a harbor of refuge at this place.

No expenditure was made.

REVERE BREAKWATER.

By chapter 108 of the Resolves of 1905, and chapter 99 of the Resolves of 1906, the sum of \$55,000 was made available for the construction of a breakwater north of Cherry Island bar and east of Eliot Circle in the town of Revere.

In 1909, under contract of Feb. 18, 1907, with the Rockport Granite Company of Massachusetts and the Pigeon Hill Granite Company, jointly, the shore arm of the breakwater, 361 feet in length, 910 feet in length of the main breakwater, also a beacon of large stones projecting well above the general level of the top of the main portion of the structure, were built. In addition, Half Tide Rock and several boulders near it which obstructed the basin were removed.

The contract price was \$1.13 per ton.

On April 17, 1912, a contract was made with William H. Ellis for repairing and building up a portion of this breakwater, the repairs to extend from the northerly end of the structure south about 800 feet. The contract price for stone furnished and placed was \$1.87 per ton, and for furnishing and setting in place each iron clamp in the beacon at the outer end of the breakwater, \$3.50. Under this contract, which was made by authority of chapter 481 of the Acts of 1909, stone to the amount of 2,801 tons was placed in the structure and the beacon at the outer end.

This work was completed July 31, 1912, at a total cost of \$5,407.09.

Appropriations: —

Chapter 108, Resolves of 1905,	\$25,000
Chapter 99, Resolves of 1906,	30,000
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Total,	\$55,000

Amount expended during the year, \$5,407.09.

Total amount expended to Dec. 1, 1912, \$60,397.93.

ROCKPORT HARBOR.

In 1908 a contract was made with Thomas Fitzgibbon to remove rocks projecting above the bottom over an area on the northerly side of Rockport harbor between the new wharf, so called, and Bear Skin Neck breakwater. The work was completed Nov. 30, 1908, the contract price being \$3.98 per ton for rock removed.

In 1910 a petition, under chapter 481 of the Acts of 1909, for further improvement of this harbor was presented. Hearing has been held on this petition and an examination made, but no further action has been taken, as upon examination no obstructions were found.

Appropriation: —

Chapter 105, Resolves of 1908,	\$8,000
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Total amount expended to Dec. 1, 1912, \$7,319.70.

SCITUATE SEA WALLS.

The protection of the shores and harbor of the town of Scituate was authorized by chapter 434 of the Acts of 1900. Work has been done as follows: under contract of Sept. 20, 1900, with Taylor, Carr & Andrews, a sea wall 998 feet long was built at the Sand Hills, along the crest of the narrow beach between Scituate harbor and the ocean. The work was completed in December, 1900.

Under contract of April 17, 1902, with Ward & Cummings, the building of 1,450 feet of concrete sea wall along the crest of the beach between Damons Island and the Glades at North Scituate was provided for. The contract price was \$4.09 per lineal foot. The work was completed July 30, 1902, at a total cost of \$6,345.35. Subsequently a claim for land damages to the amount of \$2,000 was allowed by the courts on account of the building of this wall.

Under contract of Oct. 24, 1906, with Thomas & Connor, three sea walls were built as follows:—

1. Granite masonry wall, 357 feet long, in front of the Cliff House, North Scituate.
2. Concrete wall, 356 feet long, near Surfside Road.
3. Concrete wall, 700 feet long, between First and Second Cliffs, Scituate harbor.

In addition, 120 cubic yards of riprap were placed at a cost of \$1.50 per cubic yard. The contract prices for the wall were: (1) \$9.25 per lineal foot; (2) \$7.50 per lineal foot; (3) \$4.75 per lineal foot. The work was completed July 25, 1907, at a total cost of \$10,468.82.

Under contract of Oct. 29, 1906, with John T. Fitts, stone riprap protection was made at the bluff at the southerly end of the Third Cliff, the contract price being \$2.10 per ton. This work was completed Jan. 19, 1907, at a total cost of \$5,039.63.

Under contract of Nov. 29, 1907, with Thomas Fitzgibbon, stone riprap protection was made at the bluff at the southerly end of the Third Cliff. The contract prices were, \$2.05 for granite quarry grout furnished and placed, and \$1.25 per ton for field stone and boulders furnished and placed. The work was completed March 30, 1908, at a total cost of \$2,020.

Under contract of April 22, 1908, with McHale & Perkins, two sections of sea wall were built at North Scituate, one along the beach south of Beach Street, the other in extension southerly of the wall near Surfside Road. In all, 650.06 feet of wall were built at a cost of \$3,997.35. This work was completed June 15, 1908.

Under contract of Sept. 8, 1909, with Rendle & Stoddard, a concrete sea wall was built at North Scituate Beach in the gap between the wall built by the Commonwealth in 1908, extending southerly from Beach Street, and the wall built by private individuals near Surfside Road, the contract price being \$5 per lineal foot. The work was completed Oct. 28, 1909, at a total cost of \$1,524.25.

The sea walls built by the Commonwealth and those, nearly equal in amount, built by the town and by individuals, were apparently effective until the great storm of Christmas, 1909. This storm damaged nearly all the walls built by the town and by individuals and a short section of the wall built under the direc-

tion of the Board near the end of Beach Street at North Scituate. Beside the direct damage to the wall the beach was washed away to such an extent as to cause danger of undermining.

To repair the damage done at North Scituate and to anticipate and prevent, so far as possible, future damage, plans were prepared for underpinning about 250 feet of the sea wall and replacing the 120 feet of wall undermined and thrown down. To prevent the wearing away of the beach in front of the wall, spur jetties, each about 25 feet long, and extending at right angles to the face of the wall, were to be built along the whole face of the wall in this locality at distances of from 100 to 150 feet apart. A contract for this work was made with William H. Connor on Sept. 2, 1910, at a contract price of \$5.95 per lineal foot. The work was completed Nov. 3, 1910.

Appropriations: —

Chapter 434, Acts of 1900,	\$15,000
Chapter 496, Acts of 1906,	15,800
Chapter 544, Acts of 1907,	6,000
Chapter 498, Acts of 1909,	1,500
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Total,	\$38,300

Total expenditure to Dec. 1, 1912, \$39,621.21.

SCORTON HARBOR.

Scorton harbor is formed by Scorton River, a small stream in the northwesterly portion of the town of Sandwich. This river, draining an area of about 500 acres of salt marsh and creeks, empties into Massachusetts Bay through a sand beach. Before improvement by the Commonwealth this outlet shifted continually from west to east.

Under contract of June 27, 1898, with Haynes & Lake, a new outlet was excavated at a total cost of \$2,948.47. Shortly after the completion of this work the storm in November of that year greatly enlarged the cut and improved the harbor.

Subsequently, the Board reported a plan for improvement, including the protection of the mouth of the river by a stone jetty and the riprapping of the banks, at a cost of \$56,237.

In 1907 the Board was directed to expend at this harbor a sum not exceeding \$10,000. A survey was made and a modified

project for improvement prepared and carried into effect under contract of Aug. 19, 1907, with the Bay State Dredging Company, a new channel being dredged 50 feet wide on the bottom to the level of mean low water through the point of beach formed across the outlet of the channel excavated in 1898. At the outer end of the easterly bank a short, stone jetty was built, and the bank itself, for some distance, was protected by riprap. The old outlet was then closed by a sand embankment. Stone to the amount of 1,508 tons was furnished and placed and about 800 feet of channel excavated. The work was completed during 1907. In 1908 the easterly bank of the channel was protected with quarry grout.

In 1910 a petition, under chapter 481 of the Acts of 1909, for further improvement of this harbor, was presented, and, under date of May 12, 1911, a contract was made with William Sears and James H. Connolly, providing for the extension of the stone jetty from the jetty head already in place at the outer end of the channel along the bank of the channel to the high sandy ridges of the original beach. The contract price for furnishing and placing stone was \$3.10 per ton. Work was completed Sept. 10, 1911.

Appropriations:—

Chapter 442, Acts of 1898,	. . . . .	\$5,000
Chapter 516, Acts of 1907,	. . . . .	10,000

Contributions:—

Private individuals, 1911,	. . . . .	500
Total,	. . . . .	<hr/>\$15,500

Total amount expended to Dec. 1, 1912, \$17,774.34.

SESUIT HARBOR.

Sesuit harbor at East Dennis is at the mouth of a small creek emptying into Cape Cod Bay. Before improvement by the Commonwealth the harbor had been for some years considerably shoaled by sand washed in by the sea and driven from the beach at the east by the northeast winds through the break in an old jetty built in 1851.

A survey was made in 1907, and on Oct. 26, 1908, a contract was made with William Sears, and 700 feet of stone jetty was built,

the contract price being \$1.90 per ton. The work was completed in August, 1909, at a total cost of \$10,057.95.

In 1910 a petition of A. L. Crowell, chairman of the board of selectmen of the town of Dennis, and others, under the provisions of chapter 481 of the Acts of 1909, for further improvement of this harbor by extending the jetty built by the Commonwealth in 1908, was presented. On April 29, 1910, a contract was made with John Cashman & Sons Company, and an extension of about 300 feet in length was built substantially on the lines of the old jetty. Upon the completion of the work in August, 1910, stone to the amount of 5,652 tons had been placed and the jetty extended until its total length was about 900 feet. The contract price was \$1.73 per ton.

A map of this harbor is printed with the report of the Board for 1907.

Appropriations: —

Chapter 32, Resolves of 1907,	\$200
Chapter 557, Acts of 1908,	10,000

Contribution: —

Town of Dennis, 1910,	1,000
Total,	<hr/> \$11,200

Total amount expended to Dec. 1, 1912, \$20,466.30.

SIPPICAN HARBOR, MARION.

On Feb. 18, 1910, a petition of the selectmen of Marion, under the provisions of chapter 481 of the Acts of 1909, for the removal of a large boulder in Sippican harbor, was presented. An examination of the locality was made but no work has been done.

Total expenditure to Dec. 1, 1912, \$7.17.

SOUTH RIVER, SALEM.

By chapter 111 of the Resolves of 1907 the Board was directed to improve South River, in Salem, by dredging, and under contract of Dec. 14, 1908, with the Eastern Dredging Company, a channel was dredged 75 feet wide and 8 feet deep at mean low water, from about 200 feet below Union Street bridge, a distance of about 1,300 feet, toward Lafayette Street. In addition to the

dredging, two large, uncovered bowlders were removed. The contract price for dredging was 38⁵/₁₀ cents per cubic yard scow measurement. The work was completed April 24, 1909, at a total cost of \$7,939.01.

Appropriations: —

Chapter 111, Resolves of 1907,	\$5,000
Contribution, 1908,	3,000
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Total,	\$8,000

Total amount expended to Dec. 1, 1912, \$8,097.67. .

STAGE HARBOR, CHATHAM.

By chapter 47 of the Resolves of 1903 the Board was authorized to build a timber dike and structures to close the breach at the eastern end of Stage harbor, Chatham, to protect the harbor from enroachments and damage by the sea.

On June 27, 1905, a contract was made with Joseph J. Callahan to build a timber bulkhead or dike across the channel through the marsh into the eastern end of the harbor, and to extend the structure across the marsh to the sand dunes on each side, and to build timber fences supported by embankments of sand to close the valleys through the sand dunes to the south of the main dike. After this work was commenced rapid changes in the sand, caused by the action of the sea through the break in the outer beach, necessitated additional construction. The work was completed in 1905 at a total cost of \$7,475.37.

Subsequently it became necessary to repair and protect the dike, and an embankment was built along both sides of the timber work from the sand dunes at the northerly end of the dike to the cut.

Appropriations: —

Chapter 47, Resolves of 1903,	\$5,000
Chapter 90, Resolves of 1904,	1,000
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Total,	\$6,000

Total expenditure to Dec. 1, 1912, \$9,231.93.

TAUNTON RIVER.

On Feb. 23, 1910, a petition of the Taunton Board of Trade, and others, under the provisions of chapter 481 of the Acts of 1909, for the removal of rocks and shoals in Taunton River, in Taunton and Dighton, was received. Hearings have been held, an examination and survey made and estimates prepared of the cost of removing certain ledge in this river.

The Board is in favor of making an expenditure for the improvement of this portion of the river, but delay in action has been caused by the endeavor to formulate, with the United States engineer officer of the district, a plan for joint action by the State and federal government. If necessary, however, the Board will act independently to carry out this work.

Total expenditure to Dec. 1, 1912, \$410.62.

TAUNTON RIVER AND BOSTON HARBOR CANAL.

Under the provisions of chapter 104 of the Resolves of 1901 the Board made surveys and estimates as to the probable cost of constructing a ship canal from Narragansett Bay, through Taunton, Brockton and Weymouth, to Boston harbor by way of Weymouth Fore River, and reported thereon to the Legislature on Dec. 1, 1901.

A map showing the proposed location of this canal is printed with the report of the Board for 1901.

Total expenditure to Dec. 1, 1912, \$9,932.75.

VINEYARD HAVEN HARBOR.

In 1904 the Board reported on plans for the improvement of Vineyard Haven harbor, to provide safe anchorage ground for small yachts and boats. Under contract of Sept. 8, 1905, with E. S. Belden & Sons, a stone breakwater was built on the shoal ground on the westerly side of the harbor northerly of the steamboat wharf. The original project provided for a breakwater 1,200 feet long, and further appropriation having been made in 1908 the structure was extended 400 feet under contract of June 19, 1908, with E. S. Belden & Sons.

Under contract of Aug. 6, 1909, with E. S. Belden & Sons, the breakwater was further extended 183 feet at its outer end and

200 feet at the inner end, making a total length of 1,213 feet. In addition to this work iron clamps were placed in the beacons at the outer ends of the structure. The contract prices were \$1.23 and \$1.53 per ton for furnishing and placing stone in the breakwater and jetty, and \$5 each for the iron clamps. The work was completed in 1909 at a total cost of \$9,996.72.

The Commonwealth, on Sept. 9, 1910, conveyed to the United States the title to a tract of land, 25 by 25 feet, under the outer end of this breakwater, for the erection of a light or other aid to navigation.

Appropriations: —

Chapter 95, Resolves of 1904,	\$500
Chapter 442, Acts of 1905,	10,000
Chapter 526, Acts of 1908,	10,000
Chapter 500, Acts of 1909,	10,000
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Total,	\$30,500

Total expenditure to Dec. 1, 1912, \$30,231.86.

WATCH HILL, CHATHAM.

The Legislature, by chapter 126 of the Resolves of 1909, directed the Board to make a survey and report as to the necessity, advisability and cost of constructing sea walls, breakwaters or other structures to protect the town of Chatham from encroachments or damage by the sea. In case the Board found immediate action necessary for the protection of the town, the resolve authorized an expenditure of \$15,000 for the purpose.

A project was adopted providing for the protection of the shore line and bluffs in the vicinity of Hotel Mattaquason, and a contract was entered into with Sears, Eldridge & Taylor, for placing granite quarry grout and chips on the easterly side of Watch Hill and the low bluff stretching northerly from this point in front of said hotel. The work was completed in December, 1909, at a total cost of \$14,968.75.

Appropriation: —

Chapter 126, Resolves of 1909,	\$15,000
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Total amount expended to Dec. 1, 1912, \$14,968.75.

WAQUOIT BAY.

Waquoit Bay, located in the southeastern portion of the town of Falmouth, in 1900, emptied at its southern end into Nantucket Sound, through an opening about 250 feet wide.

Under authority of chapter 42 of the Resolves of 1900 a survey of this bay was made and projects for its improvement and estimates of cost prepared as follows:—

1. For improving the entrance by building stone jetties and dredging at a total cost of \$88,300.

2. For cutting a channel through the beach to the west of the existing entrance and the protection of the new entrance by jetties at an estimated total cost of \$73,000.

3. This project differed from the others only in cutting a new channel to the east of the existing entrance, the total cost with the jetties being estimated at \$61,380.

It was reported that while the carrying out of any one of these projects would undoubtedly increase the use of the bay, the public advantage could hardly be deemed commensurate with the cost. No further appropriations have been made and no work of improvement undertaken.

A map of this bay is printed with the report of the Board for 1900.

Appropriation:—

Chapter 42, Resolves of 1900,	\$1,000
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Total expenditure to Dec. 1, 1912, \$701.61.

WEST BAY, OSTERVILLE.

Work at West Bay, Osterville, in the town of Barnstable, was commenced by the Harbor and Land Commissioners under authority of chapter 483 of the Acts of 1897.

Under contract of July 7, 1898, with George H. Cavanagh, a channel 100 feet wide and 3 feet deep at mean low water was excavated from Vineyard Sound into and through South Bay to a point where there was a depth of 3 feet of water at mean low tide. This cut was protected by the erection of two timber jetties. Subsequently the jetties were strengthened with stone

riprap. The dredging of the channel, including the removal of a shoal formed inside the inner end of the jetties, was completed in July, 1900.

Further protective work was done in 1901, and under contract of Aug. 8, 1902, with John H. Gerrish, further dredging was done in the channel from the sound to the bay, the result being a channel width of not less than 100 feet, a width of 150 feet through the higher portion of the shoal and a depth of not less than 4 feet at mean low water throughout the length of channel.

Except for repairs upon the jetties, no further work was done at this locality until 1907, when a contract was made with John H. Gerrish to remove the existing westerly jetty, to build a stone one farther west, to strengthen and improve the easterly jetty, and to dredge the channel between the jetties and in the bay. This work was completed Jan. 14, 1909.

In 1911 the easterly jetty was reconstructed under contract of May 31, 1911, with E. S. Belden & Sons, which covered work at both East Bay and West Bay. The contract prices were \$2.73 per ton for stone furnished and placed, and \$11 for each iron clamp used to secure the stones forming the jetty head. Stone to the amount of 2,121.9 tons was placed in the West Bay jetty. The work was completed Aug. 23, 1911, at a total cost of \$5,916.43.

A map of this Bay is printed with the report of the Board for 1911.

Appropriations: —

Chapter 483, Acts of 1897,	\$8,500
Chapter 440, Acts of 1898,	7,500
Chapter 491, Acts of 1902,	7,500
Chapter 523, Acts of 1907,	10,000
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Total,	\$33,500

Total amount expended to Dec. 1, 1912, \$45,423.45.

WEST FALMOUTH HARBOR.

A survey of the channel of the harbor at West Falmouth and a report, with estimates of cost of dredging, was made by the Board in accordance with the provisions of chapter 31 of the Resolves of 1906. Under contract of July 15, 1907, with John H. Gerrish, a

channel 50 feet wide on the bottom and 6 feet deep at mean low water was dredged from deep water west of Abbott's Point to the town landing. During the dredging it was found necessary to blast and remove a large boulder projecting into the channel just inside Abbott's Point. The contract price was $32\frac{7}{10}$ cents per cubic yard, and the work was completed Jan. 10, 1908.

Under contract of Aug. 14, 1908, with John H. Gerrish, a channel 50 feet wide and 6 feet deep at mean low water was dredged through the bar at the entrance to the harbor; an anchorage basin 300 feet wide, 350 feet long and 6 feet deep at mean low water, between Abbott's Point and the town landing, was dredged; and the angle in the channel opposite Abbott's Point was rounded off and dredged to a depth of 6 feet at mean low water. The contract price was 38 cents per cubic yard, and the work was completed May 21, 1910.

Under contract of July 2, 1909, with John H. Gerrish, the channel at the entrance to the harbor was widened 50 feet, the anchorage basin east of Abbott's Point was extended toward the public landing, and an anchorage basin was dredged on the south-erly side of the channel east of Chapoquoit Island. The contract prices were 38 cents per cubic yard for dredging the entrance channel and 30 cents per cubic yard for dredging the anchorage basins. All dredging was to a depth of 6 feet at mean low water. The work was completed July 1, 1910.

Appropriations: —

Chapter 31, Resolves of 1906,	\$500
Chapter 512, Acts of 1907,	5,000
Chapter 112, Resolves of 1908,	10,000
Chapter 138, Resolves of 1909,	10,000
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Total,	\$25,500

Total amount expended to Dec. 1, 1912, \$24,386.18.

WILD HARBOR.

Wild Harbor, Falmouth, is a small bay or cove on the easterly shore of Buzzards Bay, opening to the southwest. The mouth of the bay is so wide that practically none of the area suitable for the anchorage of boats is protected during the summer from the pre-

vailing southwesterly winds. A survey and examination of this harbor for the purpose of determining the best method of improvement, and the cost of the construction of a breakwater at the entrance, was directed by chapter 112 of the Resolves of 1907.

After examination and survey the Board reported a project for building a breakwater at a cost of \$25,000. By chapter 147 of the Resolves of 1908 an appropriation of \$5,000 was made for this work. After consideration it was decided that so little work could be done with this appropriation that it was inexpedient to begin construction until a larger sum was available. A petition was presented in 1910, under chapter 481 of the Acts of 1909, for the improvement of this harbor, but no work was undertaken and the petitioners were granted leave to withdraw.

A map of this harbor is printed with the report of the Board for 1907.

Appropriations: —

Chapter 112, Resolves of 1907,	\$150
Chapter 147, Resolves of 1908,	5,000
	<hr/>
Total,	\$5,150

Total amount expended to Dec. 1, 1912, \$100.27.

APPROPRIATION FOR SURVEY AND IMPROVEMENT OF HARBORS.

By chapter 93 of the Acts of 1912 an appropriation of \$3,000 was made for surveys of harbors and for improving and preserving the same, and for repairing damages occasioned by storms along the coast line or river banks of the Commonwealth.

Expenditures from this appropriation have been made to Dec. 1, 1912, in the locality and to the amount following, viz.: —

Deacons Pond harbor, Falmouth, repairing jetty, . . .	\$400
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WORK OF THE UNITED STATES IN RIVERS AND HARBORS OF THE COMMONWEALTH.

The Board is indebted to Col. Frederic V. Abbot, Corps of Engineers, U. S. A., who is in charge of river and harbor improvements in eastern Massachusetts, and Col. John Millis, Corps of Engineers, U. S. A., who is in charge of similar work in southern

Massachusetts, for the following statements, which show the work accomplished in the rivers and harbors of the Commonwealth during the fiscal year ending June 30, 1912:—

STATEMENT OF COL. FREDERIC V. ABBOT, CORPS OF ENGINEERS, U. S. A.

In accordance with your request of the 2d instant, the following summary is furnished of work accomplished by the United States during the fiscal year ending June 30, 1912, upon the improvement of rivers and harbors in Massachusetts under the charge of this office, excepting work in Boston harbor within the area defined in chapter 748 of the Acts of 1911:—

Newburyport Harbor.

Twenty-three thousand one hundred and fifty-eight tons of rubblestone were deposited in the north jetty in bringing the portion of the core which was uncompleted in the previous fiscal year (a length of about 425 feet) up to the grade of 12 feet above mean low water, with a width of 5 feet on top, and extending the core for a further distance of 625 feet, with the same grade and width.

Merrimac River.

There were dredged 6.573 cubic yards of bowlders from below Rocks bridge; 5,994 cubic yards of sand, gravel and stones, and 14.765 cubic yards of bowlders at Porters Island; 12,801 cubic yards of sand, gravel and stones, and 6.023 cubic yards of bowlders at Curriers Shoal, — a total of 18,795 cubic yards of sand, gravel and stones, and 27.361 cubic yards of bowlders.

Harbor of Refuge, Sandy Bay, Cape Ann.

Superstructure construction was continued during the year, 97.2 linear feet of the southern arm being rebuilt to a new experimental type of cross section designed to better withstand the severe winter storms of this locality; and 90.8 linear feet of the same type were built on the western arm.

Gloucester Harbor.

In continuing the work of protecting the breakwater, 14,991 tons of rubblestone were deposited along the front of the seaward wall of the superstructure.

Lynn Harbor.

Twelve thousand five hundred and ninety-five cubic yards of material were dredged in completing the removal of a shoal about 4,500 feet long, along the western side of the inner channel, and 2,680 cubic yards were dredged in maintenance of the channel completed in 1908.

Provincetown Harbor.

Thirty-two thousand one hundred and forty-five tons of stone were deposited in the dike being built across House Point Island flats.

Plymouth Harbor.

In repair of 1,301 feet of the riprap dike, 3,230 tons of stone were deposited.

Removal of Wrecks.

Work on the removal of the five-masted schooner "Davis Palmer," which was in progress at the close of the previous fiscal year, was continued until Oct. 1, 1911, when it was suspended because of the impracticability of working at the exposed location of the wreck except during the summer. To June 30, 1912, the contractor had not resumed operations. The removal of the wreck was completed Aug. 22, 1912.

The wreck of the schooner "Howard A. Hunt," which, in January, 1912, drifted out of a dock in Plymouth harbor to a position where it became an obstruction to navigation, was removed.

FREDERIC V. ABBOT,
Colonel, Corps of Engineers.

Statement of Col. John Millis, Corps of Engineers, U. S. A., showing the work done by the United States on the rivers and harbors of Massachusetts under the Newport, R. I., engineer office, during the fiscal year ending June 30, 1912: —

Hyannis Harbor.

No works of improvement were in progress during the year. The United States project for the improvement of this harbor has been completed. The only work contemplated is for maintenance.

Nantucket Harbor.

The work of widening and deepening the jetty channel in progress at the close of the last fiscal year was completed Sept. 27, 1911. A total of 299,542 cubic yards of sand were taken from the channel and the bar outside the end of the jetties, leaving it with a width of 200 feet and depth of 15 feet, with a central width of 100 feet, 17 feet deep.

Woods Hole Channel.

Under date of Aug. 7, 1911, a contract was entered into with John R. Burke of Wollaston, Mass., for removing to a depth of 13 feet at mean low water the shoal spots found in the main channel. For the purpose of this contract the 300-foot wide channel was divided into three sections, each 100 feet wide, the central section to be cleared first and the contractor to have the option of continuing on the other two or of discontinuing the work after the completion of the first section. The price to be paid is the lump sum of \$16,550 for each section. The obstructions are scattered over a length of about 2,500 feet in the channel, and the tidal currents are so strong that work can be carried on only near the periods of slack

water. The material is mainly boulders with small amounts of gravel. Work under the contract was commenced in September, 1911, and the first section was nearly completed at the close of the fiscal year.

New Bedford and Fairhaven Harbors.

A continuing contract for the completion of the project for this harbor was entered into on Aug. 31, 1911, with G. H. Breymann Bros. of Toledo, O., the work to be finished by Nov. 4, 1913. The price for all dredging was $11\frac{3}{4}$ cents per cubic yard and \$5 per cubic yard for boulders exceeding $1\frac{1}{2}$ cubic yards each. Work was commenced September 26, and up to the close of the fiscal year 973,522 cubic yards of dredged material and 21.9 cubic yards of large boulders had been removed, by which the approach-channel, 300 feet wide and 25 feet deep, was practically completed and a considerable addition made to the 25-foot-deep anchorage area. The river and harbor act of July 25, 1912, provided for the extension of the project by dredging a channel in Acushnet River 18 feet deep at mean low water and 100 feet wide from the upper end of the existing project to Belleville. This extension of the project is dependent upon the city of New Bedford, or other local agency, building a new bridge at Coggeshall Street, with at least one draw opening 100 feet wide, and building a substantial wharf on the city property at Belleville.

Taunton River.

No works of improvement were in progress during the fiscal year. The cleaning of the channel of obstructing shoals between Dighton and Briggs wharf is contemplated during the working season of 1913.

Fall River Harbor.

Dredging with the United States dredge "Gedney," in progress at the close of the last fiscal year, was continued during the year with some interruption from ice and the necessity for boiler repairs. The amount of material removed was 240,668 cubic yards, making a total under the improvement of 476,855 cubic yards. The work was confined to the shoal in the central part of the harbor.

Wrecks.

The following wrecks were removed so as no longer to form obstructions to navigation: —

Schooner "Ada Ames." — Sunk between the Shovelful Light Vessel and Monomoy Point in about 24 feet of water. The vessel had been loaded with lime, sprung a leak, burned and sank.

Schooner "A. G. Cole." — What was supposed to be the bottom of this vessel, about 125 feet long and 30 feet wide, was lying on the west side of Monomoy Island about halfway between Monomoy Life Saving Station and Monomoy Point Station, and half a mile from shore in 8 to 10 feet of water.

These two wrecks were destroyed between Aug. 7 and 19, 1911, using about 1,100 pounds of dynamite in 174 charges.

Schooner "Lois V. Chaples." — Loaded with coal bound from New York to Kittery, Me. Sprung a leak in a gale of wind and sank in Nantucket Sound, Nov. 3, 1911, about $1\frac{5}{8}$ miles west $\frac{1}{2}$ north from Handkerchief Shoal Light Vessel.

Schooner "Hannah F. Carleton." — Loaded with anthracite coal bound for Castine, Me. Sank late in November or early in December, in Nantucket Sound, about $1\frac{1}{2}$ miles northwest by west $\frac{1}{2}$ west from Handkerchief Shoal Light Vessel.

The "Chaples" and "Carleton" were removed under one contract.

NONTIDAL RIVERS AND STREAMS.

The powers and duties of this Board, some of which in respect to Boston harbor have been affected by the provisions of chapter 748 of the Acts of 1911, are set forth in considerable detail in the report of the Board for the year 1911, pages 5-7.

This Board was established in 1879, with power additional to that conferred upon the Board of Harbor Commissioners in 1866 relating to tide waters. In 1885 its jurisdiction was extended over the Connecticut River and its banks, with authority to deal with this nontidal river in the matter of building certain structures and doing other work substantially as in the case of tidal rivers and harbors.

In 1888 its jurisdiction was further extended to Great Ponds in the Commonwealth containing in their natural state more than 10 acres of land, the provisions of law, so far as they could apply to other than tide waters, being made applicable to the licensing and building of structures, and other work, in said ponds.

In 1909 the Board was authorized and directed to expend certain sums of money in improving and protecting rivers, harbors, tide waters and foreshores, — a delegation of authority previously exercised by the General Court, — thus obviating the necessity in many cases for filing petitions and obtaining special acts of the Legislature for doing work of this character.

In the opinion of this Board it is now necessary and desirable that supervision, regulation and control as broad and comprehensive as that now given over tidal rivers and harbors be provided with respect to nontidal rivers and harbors. In view of the fact that the attention of the public at large is now greatly centered on the important question of conservation and control of natural

resources, it is respectfully recommended that a more extended jurisdiction than that hitherto conferred be given this Board, and that it be authorized to collect data and all necessary information concerning structures built on nontidal rivers and streams for power purposes, the authority therefor, the uses made thereof, the amount of developed and undeveloped water power in this Commonwealth, and that it be given authority to pass upon all questions concerning the overflowing of or injury to any lands by the construction of dams, to determine the amount of damages to be paid, the terms and conditions under which dams and other structures may be built and maintained, the amount of toll to be charged and the compensation of any kind paid, and to approve the issue of capital stock and bonds. The above recommendations, with other details, are embodied in a bill which has been submitted.

BEACHES.

Under the provisions of chapter 96 of the Revised Laws this Board may, if it appears that the removal of material from any beach, shore, bluff, headland, island or bar, in or bordering on tide waters, or the destruction of any trees, shrubs, grass or other vegetation growing therein, is, or is likely to prove, injurious to any harbors or other navigable tide water, prohibit the same.

Special legislation has been enacted prohibiting the removal of material from beaches in the town of Hull, and in other places, without the consent of this Board, leaving, however, many localities where only the provisions of chapter 96 of the Revised Laws apply, with the result that the injury is often done before information on which the Board can act is received and notice can be given under the law. Furthermore, the authority to permit the removal of material from certain beaches appears to be vested in the public authorities of the city or town in which the beaches are located, the consent of this Board to such removal not being specifically required by law. Legislation is recommended providing that the consent of this Board be obtained before removing material from any beach, shore, bluff, headland, island or bar, in or bordering on tide waters, excepting within the limits of Boston harbor as defined in chapter 748 of the acts of the year 1911.

A draft of a bill to carry this recommendation into effect has been filed.

CAPE COD CANAL.

Under the provisions of chapter 448 of the Acts of 1899, incorporating the Boston, Cape Cod & New York Canal Company, the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners were constituted a Joint Board for the purpose defined in said act. The act of 1899 was amended by chapter 476 of the Acts of 1900. Additional legislation is contained in chapter 519 of the Acts of 1910.

Statements covering previous proceedings before this Board and the Joint Board, and action taken on the several petitions presented, are contained in the reports of the Board for the years 1907, pages 98-104; 1909, pages 17-19; 1910, pages 34-38; 1911, pages 65-68.

On Nov. 1, 1911, a petition of the canal company was presented to the Harbor and Land Commissioners for an amendment of the permit granted to said company June 13, 1910, in respect to the depositing of dredged material at the dumping ground in Buzzards Bay, between Abiel's Ledge and Dry Ledge. On Jan. 3, 1912, the Board granted the following permit: —

BOSTON, January 3, 1912.

The Boston, Cape Cod and New York Canal Company is hereby authorized by the Board of Harbor and Land Commissioners to dump material dredged from the approach channel of the Boston, Cape Cod and New York Canal authorized by chapter 448 of the Acts of 1899, in Buzzards Bay between Abiel's Ledge and Dry Ledge on the area shown on the chart of Buzzards Bay accompanying permit from the Board to said Canal Company dated June 13, 1910, subject to the provisions of chapter 229 of the Acts of 1907, to the laws of the United States, and to the following conditions and restrictions:

(1) The transportation and dumping of all dredged material shall be done under the supervision of this Board as provided in section 1 of chapter 229 of the Acts of 1907.

(2) The dumping ground authorized by this permit may be used for the depositing of material from both large and small scows.

(3) All dumping under this permit shall be done at such times, in such manner and in such places on said dumping ground as the inspector employed by this Board under the act of 1907 aforesaid may prescribe and direct, but all material dumped under this permit shall be deposited below a level of not less than 18 feet below mean low water.

(4) This permit may be modified or revoked by the Board at any time, and is in substitution of the permit from the Board of June 13, 1910, aforesaid.

GEO. E. SMITH

SAMUEL M. MANSFIELD

CHAS. C. PAINE

Harbor and Land Commissioners.

On Dec. 19, 1911, and on March 19, June 19, and Sept. 28, 1912, orders were passed certifying and approving the issue by the canal company of stock and bonds aggregating 9,690 shares of stock and \$970,000 in bonds, making authorization to Dec. 1, 1912, of a total of 30,760 shares of stock of the par value of \$100 each, and \$3,080,000 in bonds.

These orders in relation to stock and bonds were issued in accordance with the requirements of chapter 448 of the Acts of 1899, as amended by chapter 476 of the Acts of 1900, and upon requisitions of the Cape Cod Construction Company to the Boston, Cape Cod & New York Canal Company for the amounts of stock and bonds of said Canal Company under and in accordance with the contract between said Canal Company and said Construction Company, dated March 27, 1907, accompanied by estimates made by the chief engineer of the Canal Company as to the amount of work done and expenditures made, which had previously been examined and verified by the Joint Board and its engineer.

On May 15, 1912, hearings were held on three petitions of the Canal Company, filed April 30, May 6 and May 7, 1912, respectively, for an extension of time within which to complete the Boston, Cape Cod and New York Canal, for a determination of what bridge or bridges, ferry or ferries across the Boston, Cape Cod and New York Canal, or tunnel or tunnels under the same shall be built by the petitioner at the point of crossing in the village of Sagamore designated by the County Commissioners of Barnstable County by an order made April 30, 1912, and for approval of a supplemental agreement between the Canal Company and the Cape Cod Construction Company for extension of time within which to complete the canal.

On May 15, 1912, an order was passed approving a supplemental agreement between the Canal Company and the Cape Cod Con-

struction Company, authorizing the Canal Company to extend the time within which the Construction Company shall complete the canal to June 3, 1914. No further action has been taken during the year on the petition relating to the crossing at Sagamore.

Progress on the canal during the year 1912 is shown by the following statement furnished by the canal company:—

Work on the breakwater at the eastern entrance of the canal was carried on from May until December, and the structure is now more than 95 per cent. completed. The work remaining to be done is the placing of large stones on the south face and the completion of the extreme end.

The work of paving the banks of the canal was resumed in May, and the banks are now protected on both sides for over 10,000 feet.

From the eastern entrance of the canal dredging has been carried 14,500 feet. The hydraulic dredge "General Mackenzie" was taken from the canal early in the summer, as the material then encountered was not suitable for hydraulic work. The large dipper dredge "Governor Herrick" was started to work in the heading early in July, and is now making an advance of about 25 feet per day. A second dipper dredge is following the "Governor Herrick," completing the channel.

In the canal between Sagamore and Bournedale one steam shovel has worked throughout the year and two additional shovels since July. These shovels are removing all material above high water. There remains at this time about 250,000 cubic yards for steam shovel work. In August a steam shovel was placed at work between Bournedale and Bourne, and is now excavating 10 feet below the surface of the water in the Monument River at this point. The pit is being kept dry by pumping.

During the summer a 15-inch suction dredge was erected in the river about half a mile above Bourne village. This dredge has excavated a 12-foot channel 125 feet wide and one-quarter of a mile long. The material is being pumped on the adjacent marshes.

At the western end the approach-channel is now 90 per cent. completed, a 20-foot channel extending as far as the mouth of the Monument River and an 18-foot channel extending 2,000 feet above the railroad bridge. A ladder dredge and two dipper dredges have been working in the channel practically all the last year. The new 10-yard dipper dredge, "Governor Warfield," started work about the last of August, and has been working in the Monument River and is now advancing about 25 feet per day.

Material from these dredges is being deposited in the authorized dumping ground in Buzzards Bay, and that from the dredges at the eastern end in the dumping ground in Barnstable Bay.

The work of reconstructing the tracks of the New York, New Haven & Hartford Railroad was completed, work done during the last year consisting of moving the Bourne and Bournedale stations and the improving of the yard at Buzzards Bay. Trains started using the new track at

Bournedale the latter part of June and the new Bourne tracks in the middle of September.

A steel lift bridge with viaduct approaches has been built across the canal a short distance above the old road-crossing at Sagamore, and work is now being done grading the approaches to the bridge. This bridge is to take the place of the so-called Plymouth Road crossing the marsh at about the vicinity of the present temporary bridge.

A new highway has been constructed on the north side of the canal connecting the old County Road at what was known as the Collins Farm Crossing with Bournedale. This road is to take the place of the so-called Collins Farm Crossing, destroyed by the construction of the canal.

An underpass has been constructed under the relocated railroad line at Bournedale and temporary road built connecting the village of Bournedale with the County Road on the south side of the canal.

The canal is about 65 per cent. completed.

FISH WEIRS.

Under the statutes of this Commonwealth a license from this Board, or authority from the General Court, is required for the building of a wharf, pier, dam, sea wall, bridge or other structure in tide waters. Fish weirs are frequently built in localities where they are in many instances especially liable to be or become a serious menace to navigation, and yet there is no existing law which provides for the same procedure, as in the case of a wharf or other similar structure, and the obtaining of license therefor from this Board before building the same.

Chapter 91 of the Revised Laws, section 116, provides that —

The mayor and aldermen of a city and the selectmen of a town lying upon tide water, except cities and towns bordering on Buzzards Bay, may in writing authorize any person to construct weirs, pound nets or fish traps in said waters within the limits of such city or town for a term not exceeding five years, if such weirs, pound nets or fish traps do not obstruct navigation or encroach on the rights of other persons.

In view of the above provisions of law in respect to obstructing navigation, it is recommended that said section 116 of the Revised Laws be amended so as to provide that no authority or license given thereunder shall be valid unless approved in writing by this Board. A draft of a bill to carry this recommendation into effect has been filed.

GREAT PONDS.

During the year the Board has considered applications for leases of islands and for privileges in Great Ponds, and other matters relating to the building of structures, the drawing of water for use in flowing cranberry bogs, and the revocation of certain licenses previously granted.

The questions which have frequently arisen, and which are growing in importance, in relation to Great Ponds and the islands therein, make it very necessary, in the opinion of the Board, that surveys, maps and plans be made of those ponds belonging to the Commonwealth containing in their natural state more than ten acres of land; and it is recommended that this Board shall, except as otherwise provided, have charge of the lands, shores, islands and rights in Great Ponds belonging to the Commonwealth, and be given the necessary authority to make surveys, examinations, maps and plans thereof; to ascertain the location, extent and description of such lands, shores, islands and rights; to investigate the title of the Commonwealth thereto and ascertain what portions have been encroached or trespassed upon and the rights and remedies of the Commonwealth relative thereto; to ascertain the character and extent of all structures in said ponds or at any inlets or outlets thereof; to ascertain the ownership or control of any water power; and the use made of the developed water power; what rights and privileges have been granted by the Commonwealth in respect to the waters of said ponds, and the authority under which any water power has been developed and is being used, and the conditions, if any, on which such authority was given and whether such conditions have been complied with.

A list of Great Ponds in Massachusetts is published in the report of the State Board of Health for the year 1872, but this list, as well as the areas given therein, is only approximately correct. There has been no list made thus far of the islands in Great Ponds belonging to the Commonwealth.

A draft of a bill to carry the above recommendations into effect has been filed.

HOUSATONIC RIVER.

The survey of Housatonic River in the town of Sheffield, under the direction of this Board, was authorized in 1910 and 1912. In

addition to making the survey the Board was directed, in part, to determine the change made in the banks of the river by the building of the dam of the Berkshire Power Company at North Canaan, Conn.

Periodic flooding seems to have been a persistent characteristic of this river since 1829. Two references to the river occur in "Field's History of Berkshire County," one in its preliminary chapter and the other in the chapter upon Sheffield.

Along the Housatonic in Berkshire County to Pittsfield, there is an interval of alluvial (made) land, very rich, easily cultivated, yielding abundance of grass. It is wider in the south part of the county, and occasionally disappears from the near approach of the hills; but often extends from one fourth of a mile to a mile in width. A considerable portion of it is annually overflowed by the melting of the snows in March, presenting a flood of waters in some places a mile in width in Sheffield, and varying from a foot to ten feet in depth, according to the inequalities of the surface. This flood is of great consequence in enriching annually the soil of this interval. On great falls of water in summer, much damage is sometimes done to the grass and crops in this interval, by the rise of the river. Through the southern part of the county, the river appears at different times to have had its bed over nearly the width of the interval. The deep hollows and coves in the meadows, in some of which water continues many feet in depth through the year, prove clearly where its bed once lay. It is continually changing its course now, slowly but constantly wearing away from one bank, and forming alluvion on the other; and in this progress often uncovering trees from one to two or three feet in diameter, in a state of complete preservation, often at a depth of six, eight and ten feet below the surface. These trees must have been buried for ages. ("Field's History of Berkshire County," 1829.)

The principal stream of water in the town is the Housatonic River, here a silent, sluggish stream, from six to eight rods in breadth. It runs from north to south through the whole extent of the town into Connecticut, and empties itself into the sea, on Long Island Sound, between Milford and Stratford. Over this stream, within the town of Sheffield, are six bridges, which are supported at considerable expense, being often injured and sometimes carried away by the rise of water, which frequently inundates the whole vast tract of land through which it passes. ("Field's History of Berkshire County." Chapter on Sheffield.)

In some portions, particularly in the southern part of the county, the land is often overflowed by the melting of the snow in the spring, causing a great flood. This flood brings down rich earth from the fields above and scatters it on the lands overflowed. ("Waters of Berkshire County," Eugene Bouton.)

Under chapter 86 of the Resolves of 1908 it was provided that —

The attorney-general is hereby authorized and directed to inquire and determine to what extent, if any, the sovereignty of the commonwealth has been violated by the Berkshire Power Company, a Connecticut corporation, which, by the erection and maintenance of a dam across the Housatonic river in the state of Connecticut, some distance southerly of the line between said state and the town of Sheffield in this commonwealth, is alleged to have overflowed lands and highway in said town, causing great hindrance to public travel and menacing the public health. And the attorney-general is authorized to institute such proceedings in the premises in courts outside of this commonwealth as he may deem expedient, in the name and at the expense of the commonwealth.

The report of the Attorney-General for the year ending Jan. 10, 1910, states the facts, cites cases bearing on the questions involved, and concludes as follows: —

It seems to me that we have here exactly the case of a servitude created in one State upon lands situated in another, against which no provision has been enacted in the State where the land is situated, and where full and adequate means of assessing damages have been afforded to individuals or corporations in their property; and that, so far as concerns the flowing of the land and the injury to private owners, there is no ground for action upon the part of the Attorney-General.

Upon the score of public health there is no evidence to show that any such situation exists as requires the intervention of the Supreme Court of the United States. The general public appears to be affected only to a limited extent, even by the flowing of riparian land and a section of some hundred yards in length of a highway and lesser damage to one or two other highways in the town of Sheffield. When one contrasts the statement of the situation at Sheffield, of the portion of the public affected, and of the very slight grounds for action upon the part of the Commonwealth as a sovereign State, with the situation of which the State of Georgia complained, in *Georgia v. Tennessee Copper Co.*, *supra*, where the allegation of the bill, that a wholesale destruction of forest, orchard and crops was going on, and other injuries were being done and threatened in five counties, was amply sustained by the proof offered to the court, who found that noxious gas was carried by the wind great distances and over great tracts of Georgia land, — it seems hardly necessary to seek further authority for the proposition that it would be impossible to prove a case based upon the condition in Sheffield, which would bring an action by the Commonwealth against the Berkshire Power Company, a corporation and citizen of Connecticut, within the principle laid down by the Supreme Court of the United States as governing action by a State against a citizen of another State.

By chapter 110 of the Resolves of 1910 the Board was authorized and directed to cause that part of the Housatonic River which is within the town of Sheffield to be surveyed and plotted for a distance of not less than 10 miles, commencing at the Connecticut line and following the course of the river northerly; to inquire and determine to what extent, if any, the banks of this river have been changed; the abutments of bridges over the same weakened; the lands and highways in Sheffield overflowed, made wet or swampy by the erection and maintenance of the dam across this river of the Berkshire Power Company of North Canaan, Conn. The resolve also provided that a copy of the survey be prepared and deposited in the South Berkshire registry of deeds, and that it or an attested copy shall be competent evidence in any judicial proceeding, of the facts therein contained.

The State map shows that the river is not crossed by a 20-foot contour between the dam and a point about $1\frac{1}{4}$ miles (air line) north of the State line, and not again between that point and a point $6\frac{3}{4}$ miles (air line) north, $1\frac{3}{4}$ miles south of the village of Great Barrington. South of the State line the course of the river is fairly straight, through a comparatively narrow valley, but north of the line the valley broadens to an average width of $1\frac{1}{2}$ to $1\frac{3}{4}$ miles. The river crosses and recrosses this valley, and in its course flows 14 miles or more over an area 8 miles in length (air line), between the State boundary and the point where it is crossed by the 20-foot contour $1\frac{3}{4}$ miles south of Great Barrington.

An examination of this river was made in the summer of 1910, and it was estimated that the cost of the survey would be from \$1,500 to \$2,000, and even the larger amount might be exceeded by reason of further necessary work as the survey progressed, to comply fully with the requirements of the resolve.

Inasmuch as this resolve did not provide funds for doing the required work no further action was taken by the Board.

Chapter 111 of the Resolves of 1912 provided —

That there be allowed and paid out of the treasury of the commonwealth a sum not exceeding two thousand dollars for the purpose of carrying out the provisions of chapter one hundred and ten of the resolves of the year nineteen hundred and ten authorizing the board of harbor and land commissioners to make a survey of the Housatonic river in the town of Sheffield.

In pursuance of the provisions and requirements of this resolve 10 triangulation stations were established in June, 1912, along the river at intervals of about 1 mile, between the northern and southern boundaries of Sheffield. In September, 1912, the Board made an inspection of a portion of this river, and a plane-table survey, based upon the scheme of triangulation connected with the main system executed under the direction of this Board and covering the entire State, was commenced. In addition to the party engaged on the topographical portion of the work, a party consisting of a leveller and two rodmen were in the field between Sept. 17 and Oct. 18, 1912, employed in running a line of precise levels from the dam of the Berkshire Power Company, in the town of North Canaan, Conn., to the upper covered bridge in Sheffield, Mass., about $5\frac{1}{2}$ miles in an air line north of the State line. Fifty-five benches were established at points at or near the river bank. Gauges were placed at the following points and daily readings taken: —

On the east shore of the river about 150 feet above the dam.

On the northerly shore of an inlet of the river, a short distance west of the steam, highway and electric bridges near property of Geo. H. Blodgett in Sheffield.

On the west shore of the river about 350 feet below the lower covered bridge, in the village of Sheffield.

A table was prepared showing the elevation of the water surface as deduced from the readings at the gauges, for a period of thirty days, assuming the crest of the dam as elevation 200.000, the top of the flash boards being about 3 feet higher than the crest. It appeared by the table that the water surface at the dam averages about .2 feet higher than the water surface at Blodgett's bridge, which is several miles up stream.

The apparent fall of the river between Sheffield covered bridge and Blodgett's bridge is only about .2 feet, making practically a pond extending from the dam to the covered bridge.

The topographical portion of the survey was commenced Sept. 12, 1912, and completed Nov. 26, 1912. That portion of the river from the Massachusetts-Connecticut line to the Sheffield upper covered bridge, covering a distance of 12.5 miles, was surveyed, and the map is now being inked in preparatory to making a copy for the purposes set forth in the resolve.

The Berkshire Power Company is a corporation organized under the corporation laws of the State of Connecticut, and is located in the town of North Canaan. Chapter 374 of the Special Laws of the State of Connecticut, approved June 22, 1905, authorized this company to build, erect, and maintain a dam across the Housatonic River at the Toll bridge, and to take land flooded thereby, within the State of Connecticut.

Building operations at the plant, which is situated about 2 miles, air line, south of the Massachusetts boundary, were commenced in November, 1904, and the waste gates closed September, 1905. The dam proper, that is, the concrete work, is approximately 96 feet in length and 6 feet in height, with 3-foot flash boards above the crest. There are two wheel pits, each 16 feet wide, 16 feet deep and 39 feet long, and three waste gates, with 8 by 16 feet openings in each. The dam was built at a very narrow portion of the river, and in order to permit the construction of the wheel pits and wasteway it was necessary to excavate on either bank to such an extent that the cross section of the river at this point is about doubled, making it possible, when the waste gates and wheel pits are open and the flash boards removed, for a greater volume of water to pass this point within a given time than ever before. There is an auxiliary steam plant, installed since the dam was built, which is used when the river is low and at times of high water when the water below the dam backs up into the wheel pits. On a few occasions, when unusual floods have occurred, the elevation of the water below and above the dam has been the same, completely submerging the dam and reaching almost to the floor of the Toll bridge.

The present dam was erected at the approximate location of a wooden crib dam constructed about forty years ago. The erection of the crib dam caused the water to set back over portions of several farms in Massachusetts, and it was blown up by a band of Sheffield farmers within a short time after it was built.

The Berkshire Power Company furnish light and power, night and day, to the villages of Canaan (in North Canaan), Lakeville and Salisbury (in Salisbury), and the towns of Norfolk and Sharon, all in Connecticut, and the village of Millerton in the town of Northeast, N. Y.

The valley of the Housatonic River, from the falls at Falls

village, at a point about $4\frac{1}{2}$ miles below the dam, northerly for several miles into Massachusetts, is very flat and undoubtedly formed the bed of an ancient lake. Such being the case, it was anticipated that as soon as the gates were closed the water in the river would overflow and back well up into Massachusetts, and steps were taken to acquire by purchase, or make settlement for damages to, the area which it was supposed would be affected. When the gates were closed it was found that the water backed considerably farther upstream and caused much greater damage than had been expected, and suits were brought in the courts and matters heard by a master. Some awards were made in July, 1912, but it is understood that appeals have been made and that there are other claims for damages as yet unsettled.

In pursuance of the provisions and requirements of chapter 111 of the Resolves of 1912, and chapter 110 of the Resolves of 1910, the Board has made inquiry as "to what extent, if any, the banks of said river have been changed, the abutments of bridges over the same weakened, the lands and highways in said Sheffield overflowed, made wet or swampy by the erection and maintenance of the dam across said river of the Berkshire Power Company."

It has not been possible to determine precisely the location of the banks of the river as they were before the dam was built, but their location as shown on the map of the survey is substantially close to their location previous to the erection of the dam. The banks are to a considerable extent constantly changing, due largely to the nature of the soil of which they are composed. It is possible that the river has changed all over the meadow land during the past hundred years or more. This can be attributed, to some extent, to the sharp turns in the river which cause the ice in the springtime to block the flow and thus change the course of the stream.

The river is more than ordinarily crooked in its course, winding back and forth to such an extent that at time of freshet the water is held back for a much longer period than is usually the case with streams of this size. The water has always remained on the low lands for some time after a heavy rain or spring freshet; since the dam was completed and the water raised these conditions have been aggravated, not created. After a period of extremely low water, between September 20 and October 22, last, there was a day

of heavy rain which caused the water in the river to rise 7 feet at Sheffield bridge within forty-eight hours, while the gauge at Blodgett's bridge showed only a 3-foot rise during the same period; during this time the gates at the dam were regulated in such a manner that less than a foot rise was recorded. It was a week before the water at Sheffield bridge was back at a normal state, but at Blodgett's bridge and at the dam forty-eight hours were sufficient to bring about the same result.

Prior to the erection of the dam, W. S. Morton of New York, engineer for the Berkshire Power Company, ran a line of levels from the site of the dam to the mouth of Schenob Brook, a short distance north of the lower covered bridge in Sheffield. At this time the elevation of the water surface at several definite points along the river was determined. Notes of this survey were furnished the Board by the Berkshire Power Company, and the bench marks then established connected with the line of precise levels run in connection with the present survey.

By comparing the elevation of the water surface under normal conditions at the present time with that established by the Berkshire Power Company's survey, it is possible to ascertain the exact rise in the river, due to the erection of the dam, over the entire section covered by the survey of the Board. The original slope of the river was not uniform, due to a great extent to the very circuitous course which it takes through the meadows. Assuming the present level of the water in the river at a normal stage as 203, the elevation under similar conditions, before the dam was built, at the mouth of Schenob Brook was 204.2; at Sheffield lower covered bridge, 201.5; at Blodgett's bridge, 198.9; at Bartholomew bridge, 197.3; at the mouth of Konkapot River, 195.8.

There are six highway and railroad bridges in the town of Sheffield over the portion of the river covered by this survey. Careful inquiry and inspection has been made in pursuance of the provisions of the resolves, for the purpose of ascertaining to what extent, if any, the abutments of these bridges have been weakened by the construction of this dam. Claim was made that the abutments of Bartholomew bridge had settled 12 inches as a result of the raising of the river by the building of the dam, but careful inspection fails to show that there has been any settlement whatever, or that any repairs have been made to the abut-

ments since the dam was built. The town has, however, added a steel superstructure to steady the bridge which previously swayed badly when crossed by an automobile or heavy wagon.

A mile, air line, upstream from Bartholomew bridge the river is crossed by three bridges, side by side, the highway bridge being known as Blodgett's bridge. At this point the cross section of the river is contracted to such an extent that the water is held back very materially, the elevation of the water surface at times of average flow being from 3 to 6 inches higher above the bridge than below. The river is next crossed, $6\frac{1}{2}$ miles upstream, by a covered bridge at Sheffield village, the elevation of the water surface at average water at this point being about the same as at the dam.

In 1908 the town of Sheffield authorized an expenditure of \$2,000 for rebuilding the east abutment of the lower covered bridge, building abutments for the "Chase bridge," in the western part of the town, and completing the wall at "Big Elm" sluice; the first is the only piece of work pertaining to Housatonic River. The contract for this work was awarded to Fred T. Ley Company, of Springfield, and the amount expended was \$3,764.72. It is not known what portion of this amount is chargeable to the expense of building the lower covered bridge abutment. The necessity for this new abutment had been apparent for some time previous to 1908, and was in no way traceable to damage done by the construction of the dam, as the elevation of the water at this point is only about $1\frac{1}{2}$ feet higher than it was before the dam was built; in fact, what little current there previously was in the river has been done away with between this bridge and the dam except during periods of high water.

The topographical features covered by the survey and shown by the map include lands and such parts of highways as appear to have been made wet or swampy by the change in the height of the river caused by the construction of this dam. The location of the lands has been determined partly from information given on the ground by parties who claim that their property has been damaged by the raising of the river and partly by levels taken over the territory. Although it was maintained that highways had been overflowed and damaged by the building of this dam, it was found that only a part of one highway, that easterly from Barthol-

omew bridge, shown on the map, is overflowed for a short time each spring during the periods of high water in the river, a condition which prevailed before the construction of the dam, although the water remains upon the highway, as well as upon other lands near the river, for a longer time before flowing off than it did before the dam was constructed.

The appropriation for this survey was \$2,000, and the same has been entirely expended for that purpose.

PROVINCE LANDS.

Reclamation work on the Province Lands has been continued during the year in accordance with the methods previously employed, which have been fully described in reports of the Board. The work of brushing was resumed in the spring and transplanting begun as soon as the ground was in suitable condition. About 4 acres have been covered with brush during the year, and 12,000 seedling pines, 1,500 pines on the sod and 950 hills of Scotch broom have been transplanted.

The work of exterminating the brown-tail moths was begun early in the spring. During the summer it was found that the gypsy moths had invaded these lands. Vigorous methods were immediately employed, and it is reported by the superintendent that the lands are now free of these moths.

The road across the Province Lands built by the Commonwealth, and completed in June, 1901, was found this year to be in need of repairs. An expenditure of about \$500 has been made to put a portion of it in good condition, but a larger amount is needed for further repairs of a more permanent character.

During the fall about 1 acre of grass and bayberry have been transplanted and the brushing of about 20 acres of uncovered sand dunes completed.

The sum of \$164.24 has been paid into the State treasury during the year, being the amount received from licenses issued to various parties to cultivate and pick cranberries in the bogs on these lands and to mow meadow land.

In May of this year the Board accepted the resignation of George W. Tuttle, superintendent of the Province Lands, by reason of his retirement under the provisions of chapter 532 of the Acts of 1911. Frank Chase was appointed by the Board to succeed Mr. Tuttle as superintendent.

Appropriations: —

1893-1905, inclusive, aggregate,	\$48,000
Chapter 545, Acts of 1908,	10,000
Chapter 346, Acts of 1912,	10,000
	<hr/>
Total,	\$68,000

Amount expended during the year, \$2,703.53.

Total amount expended to Dec. 1, 1912, \$58,115.83.

TOWN BOUNDARY SURVEY.

The work involved in locating by triangulation the city and town boundary lines is now approaching completion. It is expected that one more field season will complete all of the outside work and finish the last group of towns in the southwest corner of the State.

During the present season the field work has been completed of a group of 22 towns called the "Agawam group," extending westerly from Connecticut River, opposite Springfield to Peru, Middlefield and Chester, and southerly to the Connecticut State line.

The scheme of triangulation for determining the corners of the towns of Becket, Lee, Tyringham, Otis, Monterey, Sandisfield and New Marlborough in Berkshire County has been laid out and signals erected, and a part of the stations occupied.

The triangulation system has also been extended south of Hancock, Pittsfield and Dalton to include corners of Richmond, Lenox, Lee, Washington and the northerly part of Stockbridge and West Stockbridge.

Descriptions and topographical surveys of the corners have been made. Special stadia surveys have been made of the following streams, 25½ miles in all: —

Westfield River and Dead Branch, between Chesterfield and Huntington.

Westfield River and Middle Branch, between Middlefield and Worthington.

Housatonic River, between Lee and Lenox.

Farmington River, between Otis and Tolland, and between Sandisfield and Tolland, including a small section west of the boundary line portion.

Connecticut River, between the Schell bridge at Northfield and the New Hampshire State line. (By plane table.)

The field season, in the main, was from the 1st of May to the middle of November.

The selectmen of Cheshire and New Ashford have marked with permanent stone monuments the new line between the two towns, established by chapter 670 of the Acts of 1912. Only two new bounds were required on this line as simplified and straightened in accordance with the recommendation of the Board, under chapter 25, section 7, of the Revised Laws.

During the survey of the previous year the line between Clarksburg and Florida, near the wooded summit of the Hoosac and Florida Mountain range, was found to be indefinite and improperly marked, and as far as the records show some corners had not been visited in regular perambulations by town officials for many years. Upon the request of the towns, a simple, compromise, straight line between the northeast corner of Clarksburg and the northeast corner of North Adams was proposed by the Board, and in August of the present year each town, at a special, local town meeting, voted to concur with the proposed change and has filed with the Board certified copies of the action taken, with a definite description of the adopted line embodied therein, and the matter will be submitted to the next General Court for ratification. No new monuments will be required to mark this line.

The line between Hinsdale and Peru, referred to in last year's report, having since been established by chapter 169 of the Acts of 1912, will require some new monuments to properly mark it, the work to be done by the selectmen and the bounds properly inspected by the engineers of this department.

The work in Berkshire County, as far as completed, shows that some corners are either not marked at all or else by an insecure or an inadequate field stone. The attention of the selectmen will be called to these points and new monuments requested.

One atlas, describing the boundaries of 22 cities and towns, viz., Belchertown, Brimfield, Brookfield, Chicopee, East Longmeadow, Granby, Hampden, Holland, Longmeadow, Ludlow, Monson, North Brookfield, Palmer, Southbridge, South Hadley, Springfield, Sturbridge, Wales, Ware, Warren, West Brookfield and Wilbraham, has been printed and 65 copies distributed in accordance with chapter 360 of the Acts of 1900, as amended by chapter 484 of the Acts of 1909.

One atlas describing the boundaries of 15 cities and towns, viz., Amherst, Barre, Dana, Enfield, Greenwich, Hadley, Hardwick, Leverett, New Braintree, New Salem, Pelham, Petersham, Prescott, Shutesbury and Sunderland, has been prepared for publication, printed, and is now in the hands of the binder. It will soon be distributed.

Up to Dec. 1, 1912, atlases describing the boundaries of 284 cities and towns, out of a total of 354 cities and towns in the Commonwealth, have been completed, and 270 distributed as provided by statute.

Computations have been made, field data reduced, and historical records compiled for the atlas known as the Adams group, containing the following 28 cities and towns, viz., Adams, Ashfield, Buckland, Charlemont, Cheshire, Clarksburg, Colrain, Conway, Cummington, Dalton, Deerfield, Florida, Greenfield, Hancock, Hawley, Heath, Lanesborough, Leyden, Monroe, New Ashford, North Adams, Pittsfield, Plainfield, Rowe, Savoy, Shelburne, Williamstown and Windsor. As soon as the drawings are made this atlas will be sent to the printer.

Computations are being made and data prepared for the Agawam group, including 22 cities and towns, viz., Agawam, Blandford, Chester, Chesterfield, Easthampton, Goshen, Granville, Hatfield, Holyoke, Huntington, Montgomery, Northampton, Russell, Southampton, Southwick, Tolland, Westfield, Westhampton, West Springfield, Whately, Williamsburg and Worthington.

SALE AND DISTRIBUTION OF MASSACHUSETTS ATLAS SHEETS AND TOWN BOUNDARY ATLASES.

Under authority of chapter 57, Resolves of 1890, chapter 42, Resolves of 1891, and chapter 360, Acts of 1900, 6,142 atlas sheets of the map of the Commonwealth and 2 town boundary atlases have been sold during the year, for which \$316.10 was received. Under the provisions of chapter 26, Resolves of 1909, there has been expended from this amount \$134.40 for the purchase from the United States Geological Survey of sheets required to keep in stock at all times copies of all the atlas sheets, leaving a balance of \$181.70, which has been forwarded to the Treasurer and Receiver-General, as required by the resolve.

Chapter 360, Acts of 1900, as amended by chapter 484 of the

Acts of 1909, directed this Board to make certain disposition of the atlases of the boundary lines of the various cities and towns in the Commonwealth. Under this authority 73 atlases have been distributed during the year.

LICENSES GRANTED DURING THE YEAR.

Nos.

3631. Petition of the county commissioners of the county of Essex for approval of plans for reconstructing Fox Hill bridge and approaches thereto over Saugus River, in Lynn and Saugus, as authorized by chapter 631 of the Acts of 1911. Granted Dec. 8, 1911.
3632. Petition of Fred W. Stuart for license to build a sea wall and pile wharf and fill solid on Bass River, Beverly. Granted Dec. 13, 1911.
3633. Petition of the Springfield Gas Light Company for license to lay an 8-inch gas main across the Connecticut River in Springfield and West Springfield. Granted Dec. 20, 1911.
3634. Petition of the county commissioners of Bristol County for license to make repairs and additions to piers of Brightman Street bridge on Taunton River, Fall River and Somerset. Granted Dec. 20, 1911.
3635. Petition of Sarah C. Lima for license to build a boathouse and wharf on Taunton River, Somerset. Granted Dec. 20, 1911.
3636. Petition of Frank P. Knight and George L. Knight for license to build a sea wall and fill solid in Manchester harbor, Manchester. Granted Dec. 20, 1911.
3637. Petition of the Wenham Lake Ice Company for license to build an ice run in Wenham Lake, Beverly. Granted Dec. 20, 1911.
3638. Petition of E. E. C. Swift, Jr., for license to excavate a ditch and take water from Little Pond, Falmouth. Granted Dec. 27, 1911.
3639. Petition of Stephen M. Weld for license to build a wharf in Buzzards Bay, Wareham. Granted Dec. 27, 1911.
3640. Petition of William A. Caldwell Company for license to build an ice run in Wenham Lake, Beverly. Granted Jan. 10, 1912.
3641. Petition of the city of Salem for license to lay a sewer in and over a tributary of South River, between Charles Street and Ocean Avenue, Salem. Granted Jan. 10, 1912.
3642. Petition of Emma S. Almy and Helen J. Butler, trustees under the will of James F. Almy, for license to fill solid and maintain filling already done in a tributary of South River, Salem. Granted Feb. 7, 1912.
3643. Petition of Le Baron R. Barker for license to excavate ditches, build flumes and pump wells and draw water from Halfway Pond, Plymouth. Granted Feb. 7, 1912.

Nos.

3644. Petition of the Old Colony Railroad Company for license to build a temporary pile bridge across Cohasset Narrows, Wareham and Bourne. Granted Feb. 7, 1912.
3645. Petition of the Boston Ice Company for license to build an ice run in Wenham Lake, Beverly. Granted Feb. 14, 1912.
3646. Petition of William Butler for license to build post and timber structures in the Mill Pond, Chatham. Granted Feb. 14, 1912.
3647. Petition of Joseph M. Avellar for license to build pile structures in Provincetown harbor, Provincetown. Granted Feb. 21, 1912.
3648. Petition of the Turners Falls Company for approval of plans for constructing dams and doing other work on the Connecticut River, in Montague and Gill, as authorized by chapter 122 of the Acts of 1854 and chapter 148 of the Acts of 1880. Granted March 20, 1912.
3649. Petition of A. E. Thacher for license to build post and timber structures in Little Mill Pond, Chatham. Granted March 20, 1912.
3650. Petition of W. B. P. Weeks for license to build and maintain a marine railway in Quamquissett harbor, Falmouth. Granted April 3, 1912.
3651. Petition of Verdo R. Westgate for license to build a pile pier and float on Taunton River, Taunton. Granted April 3, 1912.
3652. Petition of the town of Oak Bluffs for license to build a concrete culvert from Sunset Lake to Lake Anthony, Oak Bluffs. Granted April 3, 1912.
3653. Petition of the selectmen of the town of Scituate and the selectmen of the town of Marshfield, jointly, for license to rebuild a bridge across North River in Scituate and Marshfield, at Humarock. Granted April 10, 1912.
3654. Petition of the town of Fairhaven for approval of plans for building a sewer in Acushnet River, northerly of and near Coggeshall Street bridge, beyond the harbor line established by chapter 269 of the Acts of 1848, in Fairhaven, as authorized by chapter 143 of the Acts of 1912. Granted May 1, 1912.
3655. Petition of Marie S. Larivee for license to build a sea wall and fill solid in Salem harbor, Salem. Granted May 1, 1912.
3656. Petition of the French King Rapids Power Company for approval of plans for constructing a dam across the Connecticut River in Gill and Northfield, as authorized by chapter 580 of the Acts of 1908. Granted May 1, 1912.
3657. Petition of Francis W. Fabyan for license to build a boathouse and float in Buttermilk Bay, Bourne. Granted May 1, 1912.
3658. Petition of the New York Yacht Club for license to build a pile and timber pier and float stage in Vineyard Haven harbor, Oak Bluffs. Granted May 1, 1912.
3659. Petition of the Lakeside Boat Club for license to build a pile and timber platform and a float in Lake Quinsigamond, Worcester. Granted May 8, 1912.

Nos.

3660. Petition of the Beverly Gas and Electric Company for license to build a bulkhead and pile wharf and to fill solid on Bass River, Beverly. Granted May 15, 1912.
3661. Petition of Winifred E. S. Parker for license to build and maintain a pile pier in Cotuit harbor at Cotuit, Barnstable. Granted May 15, 1912.
3662. Petition of the city of Haverhill for license to construct a submerged sewer outlet in Merrimac River, Haverhill. Granted May 22, 1912.
3663. Petition of Margaret B. Day for license to build a boat landing, float and runway in Marblehead harbor, Marblehead. Granted May 22, 1912.
3664. Petition of the Wesley House Incorporated for license to build a pile pier in Lake Anthony, Oak Bluffs. Granted May 22, 1912.
3665. Petition of the Jubilee Yacht Club for license to locate two floats at Tuck's Point, Beverly. Granted May 29, 1912.
3666. Petition of the Cape Cod Cold Storage Company for license to extend its wharf on piles in Provincetown harbor, Provincetown. Granted May 29, 1912.
3667. Petition of Charles E. Chamberlain, Domingas T. Silva and Edward Murray for license to build a pile and timber pier in Buzzards Bay at the westerly end of Winsagansett Avenue, Fairhaven. Granted June 5, 1912.
3668. Petition of Emma A. Kebbler for license to lay a telephone submarine cable in and under Essex River, Essex. Granted June 5, 1912.
3669. Petition of Emma A. Kebbler for license to lay an electric submarine cable in and under Essex River, Essex. Granted June 5, 1912.
3670. Petition of the Connecticut Valley Lumber Company for license to hang and maintain booms in and across the Connecticut River in Gill and Montague. Granted June 5, 1912.
3671. Petition of the Connecticut Valley Lumber Company for license to hang and maintain booms in and across the Connecticut River in Northampton and Hadley. Granted June 5, 1912.
3672. Petition of James R. Strong for license to build a pile pier and float in Nantucket Sound, Dennis. Granted June 14, 1912.
3673. Petition of Jasper F. Pope & Son for license to build a pile wharf on Bass River, Beverly. Granted June 14, 1912.
3674. Petition of Harry K. White for license to build a pier, float and breakwater in Buzzards Bay, Wareham. Granted July 5, 1912.
3675. Petition of the town of Manchester for license to build a concrete dam in Manchester inner harbor, Manchester. Granted July 5, 1912.

Nos.

3676. Petition of the city of New Bedford for license to build a bulkhead, extend Copper Street sewer and fill solid on Acushnet River, New Bedford. Granted July 5, 1912.
3677. Petition of Abner Cohan for license to build a platform in Lake Whalom, Lunenburg. Granted July 17, 1912.
3678. Petition of Belle L. Coburn for license to build a bath house in and over Tyng's Pond, Dracut. Granted July 17, 1912.
3679. Petition of the town of Marblehead for license to locate a float and runway in Marblehead harbor, Marblehead. Granted July 17, 1912.
3680. Petition of the county commissioners of Essex County for license to extend the center pier, and jacket with wood the westerly stone pier, of Rocks bridge on the Merrimac River in Haverhill and West Newbury. Granted July 24, 1912.
3681. Petition of George F. Welch for license to build a bulkhead and fill solid in Scituate harbor, Scituate. Granted Aug. 7, 1912.
3682. Petition of the Agawam Beach Land Company for approval of plans for constructing a bridge across Shell Point Cove, Wareham, as authorized by chapter 169 of the Acts of 1910. Granted Sept. 4, 1912.
3683. Petition of Joseph A. Lamper and S. Arthur Bubier and Barton E. Kingman, trustees under the will of Mary G. Lamper, for license to fill solid and maintain filling already done in Lamper's Mill Pond, Lynn. Granted Sept. 4, 1912.
3684. Petition of the Haverhill Electric Company for license to lay a cable in the Merrimac River, Haverhill and Groveland. Granted Sept. 11, 1912.
3685. Petition of Charles R. Crane for license to build a pile wharf and float stage in Little harbor at Woods Hole, Falmouth. Granted Sept. 11, 1912.
3686. Petition of Charles R. Crane for license to build a sea wall and fill solid a portion of an existing pile wharf, to build a stone wharf in extension of a pile wharf, to build a boathouse, locate a float stage, and to dredge in Little harbor at Woods Hole, Falmouth. Granted Sept. 11, 1912.
3687. Petition of the town of Amesbury for license to build a sewer outlet in Merrimac River, Amesbury. Granted Sept. 11, 1912.
3688. Petition of the Nantucket Athletic Club for license to build a pile pier and float in Nantucket harbor, Nantucket. Granted Sept. 25, 1912.
3689. Petition of Jessie M. Barron for license to build a pier and float stages in Cohasset harbor, Cohasset. Granted Sept. 25, 1912.
3690. Petition of the county commissioners of the county of Bristol for approval of plans for constructing a highway bridge over the Acushnet River between New Bedford and Acushnet, as authorized by chapter 539 of the Acts of 1912. Granted Oct. 30, 1912.

Nos.

3691. Petition of Antonio S. Gardella for license to extend his wharf by building a sea wall and filling solid on Merrimac River, Haverhill. Granted Oct. 30, 1912.
3692. Petition of Manuel Peter Lopes for license to extend and maintain a pile structure and build and maintain a marine railway in Provincetown harbor, Provincetown. Granted Oct. 30, 1912.
3693. Petition of Jackson R. Williams for license to extend and maintain pile structure in Provincetown harbor, Provincetown. Granted Oct. 30, 1912.
3694. Petition of the Connecticut River Transmission Company for license to erect two towers on the upland at Jordan Pond, Shrewsbury, and to string wires between said towers over and across said pond for transmission purposes. Granted Nov. 20, 1912.
3695. Petition of Dexter H. Craig for license to build a wharf, partly solid and partly on piles, and to dredge in Plymouth harbor, Plymouth. Granted Nov. 27, 1912.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

- BOSTON, CAPE COD & NEW YORK CANAL COMPANY, to dump dredged material in Buzzards Bay between Abiel's Ledge and Dry Ledge. Granted Jan. 3, 1912.
- ELLEN M. BOARDMAN, to remove material from Salters Beach in Plymouth. Granted Jan. 10, 1912.
- EASTERN DREDGING COMPANY, to dredge material from Broad Sound southerly of Great Fawn Beacon, in Boston harbor. Granted Jan. 24, 1912.
- EASTERN DREDGING COMPANY, to dredge gravel from Great Brewster Spit, in Boston harbor. Granted Feb. 14, 1912.
- WILLIAM H. LESTER, to cut willows on bank of Connecticut River, at Agawam. Granted March 28, 1912.
- J. J. JEDERY, to remove sand from Merrimac River. Granted April 17, 1912.
- J. S. PACKARD DREDGING COMPANY, to dump dredged material in Buzzards Bay between Abiel's Ledge and Dry Ledge. Granted May 8, 1912.
- HARRY E. CONVERSE, to dredge in Marion harbor at Charles Neck, in Marion, and to deposit dredged material on shore. Granted June 5, 1912.
- BAY STATE DREDGING COMPANY, Ltd., to dump dredged material on flats in Saugus River near Fox Hill bridge. Granted July 17, 1912.
- FLORA E. WARREN, E. TERTIA TREIBER, HARRIET W. CHISHOLM AND MARY H. TILDEN, to remove material from beach in Hull. Granted Aug. 7, 1912.
- H. L. ANDREWS AND E. A. IWWERKS, to use and occupy a part of Berry Island in Lake Winthrop, in Holliston. Granted Sept. 18, 1912.

J. H. BESARICK, to remove material from beach at Point Allerton, in Hull.
Granted Sept. 18, 1912.

JOHN KINGSBURY, to use and occupy Rat Island in Lake Winthrop, in Holliston. Granted Sept. 18, 1912.

MARY A. DALY, to remove sand from beach at Sand Hills in Scituate.
Granted August 21, 1912.

WEYMOUTH BACK RIVER BRIDGE.

By chapter 739 of the Acts of 1911 the construction of a new bridge across Weymouth Back River connecting the town of Weymouth with the town of Hingham, was authorized, and the members of the Board of Harbor and Land Commissioners, the chairman of the county commissioners of Norfolk County, and the chairman of the county commissioners of Plymouth County, were appointed a board of bridge commissioners and directed to do the work.

This act was amended by chapter 227 of the Acts of 1912 in respect to the time for building this structure, making it eighteen months instead of one year; by allowing an expenditure of \$105,000 instead of \$80,000; by striking out that portion of the act which provided that the bridge commissioners should receive such compensation as the Governor and Council should determine; by providing that neither of the two counties shall be required to pay in the aggregate for the purposes described in the act a sum exceeding \$52,500 instead of \$40,000.

Meetings have been held during the year and inspections have been made of the locality and of the work in progress under contract of April 10, 1912, with John Cashman & Sons Company, for building the substructure of the bridge, and under contract of April 24, 1912, with the Boston Bridge Works, Inc., for building the superstructure. It is expected that all work will be completed early in 1913.

The Commonwealth, under the act of 1911 aforesaid, is required to pay 45 per cent. of the cost and expenses incurred, but of any sums that may be received from the United States in reimbursement of expenditures there shall be distributed 45 per cent. to the Commonwealth of Massachusetts, 20 per cent. to the county of Norfolk, 20 per cent. to the county of Plymouth and 15 per cent. to the Street Railway Company that may be granted a location on the new bridge.

CONCLUSION.

The closer co-operation by the Commonwealth, and to a greater degree than hitherto, with the United States government in the development of rivers and harbors by State appropriations, to supplement the expenditures of the federal government, is deemed strongly desirable by this Board. The State is now co-operating with the United States Geological Survey in a minor way by paying part of the expense of gauging certain rivers and streams.

The State possesses in the unused waters of great ponds and non-tidal rivers and streams a great and valuable asset. Many of the streams and rivers of the Commonwealth have been developed to only a small degree of their possibilities. This is particularly true of the western part of the State, which, because of the character of the country, is rich in opportunities for water power. The utilization of this unused asset of the Commonwealth by means of reservoirs, constructed either by private capital under State supervision, or by the State itself, would be of great benefit to those particular communities by the immediate stimulation of trade and industry which would thereby ensue.

Authority should be given and appropriations made for a proper and reasonable survey of the possibilities of the undeveloped water power of the Commonwealth, which, in the opinion of the Board, based on present inadequate information, amounts to many hundred thousand horse power.

Investigation should be made of the possibilities of conserving and reservoiring the immense amount of flood waters of the rivers of the Commonwealth which is now absolutely wasted so far as power or use are concerned.

The co-operation of the neighboring States of Connecticut, New Hampshire and Vermont would be necessary for this purpose, and this Board feels that such co-operation would be for the interest of all of these States and result in great benefit to their industries.

The foregoing report is respectfully submitted.

WILLIAM S. McNARY,
GEORGE E. SMITH,
CHARLES C. PAINE,
Commissioners.

APPENDIX.

APPENDIX A.

[See page 4 of this report, ante.]

CONTRACTS MADE AND PENDING DURING THE YEAR 1912.

Contract No.	Work.	Contractors.	Date.	To be completed.	Condition of Work.	Prices.	Amount.
131	Dredging near Mosquito Fleet Yacht Club House, South Boston.	Eastern Dredging Company.	Nov. 18, 1910	Dec. 1, 1911	Completed,	Excavating the anchorage basin near the Mosquito Fleet Yacht Club House, 21 $\frac{1}{10}$ cents per cubic yard, scow measure. Excavating the entrance channel, 28 $\frac{1}{10}$ cents per cubic yard, scow measure. Dredging \$4.485. Quarry grout and chips, \$2.45 per ton. Furnishing material and building sea walls, \$6.45 per cubic yard. Resetting standard, \$43. Clamps, \$14.50 each. \$2.43 per ton,	\$25,472 34
134	Improving harbor at Lake Anthony, Oak Bluffs.	John H. Gerrish,	Mar. 31, 1911	Sept. 30, 1911	Completed,	25.5 cents per cubic yard, measured in scoops. Dredging, \$9,600. Excavating ledge, \$12 per cubic yard. Stone, \$1.87 per ton. Clamps, \$3.50 each. \$7,400,	9,529 80
138	Jetty at mouth of Ipswich River, .	Thomas Fitzgibbon, . .	Apr. 14, 1911	Sept. 1, 1911	Suspended,	Stone, \$1.97 per ton. Clamps, \$7.50 each.	4,800 00
144	Dredging channel in Manchester harbor, Manchester.	Bay State Dredging Company, Ltd.	Apr. 17, 1912	Oct. 1, 1912	Completed,	12,763 77	
145	Dredging at Harbor Cove, Gloucester.	J. P. O'Riorden,	June 14, 1912	Nov. 1, 1912	Completed,	9,462 00	
146	Repairing breakwater at Cherry Island Bar, Revere.	W. H. Ellis,	Apr. 17, 1912	Sept. 1, 1912	Completed,	5,283 37	
147	Dredging channel and basin in inner harbor, Cuttyhunk.	J. S. Packard Dredging Company.	Apr. 17, 1912	Sept. 1, 1912	Completed,	7,400 00	
148	Strengthening and building up outer ends of jetties, Cuttyhunk.	E. S. Belden & Sons, . .	Apr. 17, 1912	Sept. 1, 1912	Completed,	2,672 54	

CONTRACTS MADE AND PENDING, ETC. — *Concluded.*

Contract No.	Work.	Contractors.	Date.	To be completed.	Condition of Work.	Prices.	Amount.
149	Dredging channel in Scituate harbor.	Eastern Dredging Company,	June 5, 1912	Oct. 1, 1912	Completed,	29.5 cents per cubic yard, measured in scows.	\$8,147 90
150	Dredging channel and basin in Mill River, Gloucester.	Bay State Dredging Company, Ltd.	July 24, 1912	Nov. 30, 1912	Completed,	Dredging, \$14,500. Removal of bowlders, \$25 per day.	14,750 00
151	Dredging channels in Herring River and Wicthmore harbor.	John R. Burke, . . .	Sept. 18, 1912	June 1, 1913	Not commenced.	\$13,700.	13,700 00
153	Concrete sea wall and spur jetties between Gun Rock and Green Hill, Hull.	William Sears and James H. Connolly.	Oct. 2, 1912	July 1, 1913	Not commenced.	\$5.60 per cubic yard of concrete, in place.	21,280 00
154	Dredging channel and anchorage basin in Manchester harbor, Manchester.	Bay State Dredging Company, Ltd.	Aug. 14, 1912	Dec. 1, 1912	Completed,	25.5 cents per cubic yard, measured in scows.	11,238 36
155	Building breakwater at Hyannisport.	William H. Ellis, . . .	Sept. 18, 1912	June 1, 1913	Not commenced.	Stone, \$2.40 per ton. Clamps, \$5 each.	22,359 00
156	Dredging channel and anchorage basin in Nantucket harbor.	Charles M. Cole, . . .	Nov. 30, 1912	Oct. 1, 1913	Not commenced.	24.3 cents per cubic yard, scow measure.	24,300 00

APPENDIX B.

CONTRIBUTIONS AND EXPENDITURES FOR RIVER AND HARBOR WORK
UNDER DIRECTION OF THE HARBOR AND LAND COMMISSIONERS, MADE
DURING THE YEAR ENDING NOV. 30, 1912, UNDER CHAPTER 481,
ACTS OF 1909.

LOCATION.	Character of Work.	Contribution by Municipality or Others.	Expenditure.
Annisquam River,	Dredging,	-	\$3 27
Cohasset harbor,	Dredging,	\$2,123 45	2,123 45
Cuttyhunk harbor,	Jetties and dredging,	3,000 00	10,281 15
Deacon's Pond, Falmouth,	Jetties,	-	10 00
Harbor Cove, Gloucester,	Dredging,	-	237 42
Herring River, Harwich,	Dredging,	-	224 92
Herring River, Wellfleet,	Dike,	-	985 44
Hough's Neck, Quincy,	Dredging,	-	910 63
Hull,	Sea wall,	-	235 32
Hyannisport,	Breakwater,	-	44 80
Ipswich River,	Dredging,	-	1,646 13
Lake Anthony, Oak Bluffs,	Jetties and dredging,	-	2,747 65
Lynn harbor,	Dredging,	-	199 15
Manchester harbor,	Dredging,	11,000 00	20,608 82
Menamsha Inlet,	Jetties and dredging,	-	10 30
Mill River, Gloucester,	Dredging,	-	7,605 66
Nantucket harbor,	Dredging,	-	304 08
North River, Marshfield,	Removing rocks,	-	1,059 73
Onset Bay,	Survey,	-	65 00
Pamet River,	Survey,	-	109 27
Revere,	Stone breakwater,	-	5,407 09
Rock harbor, Orleans,	Dredging,	-	189 73
Sandwich harbor,	Survey,	-	226 44
Saugus River,	Survey,	-	362 96
Scituate harbor,	Dredging,	2,000 00	8,975 05
Sippowisset,	Survey,	-	3 25
Southerly shore of South Boston,	Dredging,	-	9,404 15
Winthrop harbor channel,	Dredging,	-	1,288 06
Witchmere harbor,	Dredging,	500 00	202 21
General expenses, . . . . .	. . . . .	-	318 14
		\$18,623 45	\$75,789 27 ¹

¹ In addition, amounts due under completed contracts and estimated amounts to be paid under pending contracts approximate \$56,873.

APPENDIX C.

APPROPRIATIONS, CONTRIBUTIONS AND EXPENDITURES FOR RIVER AND
HARBOR WORK UNDER THE DIRECTION OF THE BOARD OF HARBOR
AND LAND COMMISSIONERS, FROM 1893 TO 1912, INCLUSIVE.

[Excepting Boston main harbor, as shown on page 6, *ante*, and Connecticut River, as shown on
pages 37, 38, *ante*.]

LOCALITY.	Character of Work.	Total Appropriation.	Contribution by Municipality or Others.	Total Expenditure.
Allens harbor, Harwich, . .	Survey,	\$219 50	-	\$219 50
Annisquam River and Lobster Cove.	Dredging, . . .	83,050 88	\$1,500 00	83,915 40
Apponagansett harbor, . .	Stone breakwater, .	40,500 00	-	40,221 33
Barnstable harbor,	Survey,	217 51	-	217 51
Bass River, Beverly, . . .	Dredging, . . .	25,539 81	55,535 75	81,075 56
Bass River, Yarmouth, . .	Jetties and dredging,	54,045 60	-	52,560 60
Bucks Creek, Chatham, . .	Jetty and survey, .	10,805 18	1,000 00	11,633 86
Cataumet harbor,	Survey,	500 00	-	356 33
Centreville River,	Dredging, . . .	6,103 22	1,500 00	7,603 22
Cohasset harbor,	Breakwater and dredging, . . .	30,000 05	20,691 88	50,691 93
Cotuit harbor,	Dredging, . . .	31,471 85	2,000 00	30,443 74
Cuttyhunk harbor,	Jetties and dredging,	44,185 24	8,000 00	46,611 17
Deacon's Pond, Falmouth,	Jetties and dredging,	33,557 61	12,000 00	45,557 61
Dorchester, easterly shore,	Dredging, . . .	70,363 66	-	70,171 31
East Bay, Osterville, . . .	Jetties and dredging,	23,272 10	-	22,937 54
Essex River,	Dredging, . . .	5,000 00	-	5,000 00
Green harbor,	Jetties and dredging,	90,670 95	-	76,333 26
Harbor Cove, Gloucester, .	Survey and dredg- ing,	20,179 57	-	8,971 62
Harbor View,	Dredging, . . .	10,146 00	-	146 00
Herring River, Harwich, . .	Jetties and dredging,	21,221 30	2,000 00	23,002 00
Herring River, Wellfleet, .	Dike and ditches, .	11,832 74	10,000 00	21,800 73
Hingham harbor,	Dredging, . . .	13,180 69	3,000 00	16,180 69
Housatonic River, Sheffield, .	Survey,	2,000 00	-	2,000 00
Houghs Neck, Quincy, . . .	Dredging, . . .	4,499 83	500 00	4,999 83
Hull,	Sea wall, . . .	25,235 32	-	381 06
Humarock Beach, Scituate, .	Survey,	250 00	-	236 07
Hyannisport,	Survey and break- water,	20,000 00	-	44 80
Improvement of rivers and harbors.	General expenses, .	407 56	-	407 56
Ipswich River,	Dredging, . . .	13,835 76	1,000 00	14,829 20

APPROPRIATIONS, ETC. — *Continued.*

LOCALITY.	Character of Work.	Total Appropriation.	Contribution by Municipality or Others.	Total Expenditure.
Island End River, . . .	Survey, . . .	\$264 10	—	\$264 10
Jeffries Point, . . .	Dredging, . . .	10,000 00	—	—
Lake Anthony, Oak Bluffs, .	Jetties and dredging,	48,153 63	\$2,000 00	46,944 59
Lewis Bay, Hyannis, . . .	Dredging, . . .	17,260 65	—	17,012 22
Lynn harbor, . . .	Dredging a n d survey.	33,188 42	200 00	12,987 20
Manchester harbor, . . .	Dredging, . . .	27,729 84	19,500 00	44,707 68
Menamsha Inlet, . . .	Jetties and dredging,	56,784 33	700 00	57,380 68
Merrimac River, . . .	Investigation, . .	100 00	—	—
Mill River, . . .	Survey and dredging.	13,051 01	—	13,051 01
Nantucket harbor, . . .	Dredging, . . .	26,513 23	—	16,271 47
Neponset River, . . .	Dredging, . . .	34,270 44	—	34,269 70
North River, Marshfield, . .	Survey and removing rocks.	3,632 28	1,800 00	5,432 08
Oak Bluffs, . . .	Removing rocks, . .	500 00	—	462 50
Onset Bay, . . .	Inspection, . . .	65 00	—	65 00
Orient Heights, . . .	Dredging, . . .	8,500 00	—	8,144 52
Pamet River, . . .	Survey, . . .	109 27	—	109 27
Paskamansett River, . . .	Dredging, . . .	2,187 35	—	2,187 35
Penikese Island, . . .	Pile wharf and survey.	5,300 00	—	5,192 95
Plum Island River, . . .	Survey, . . .	983 31	—	983 31
Plymouth harbor, . . .	Dredging, . . .	72,451 83	71,294 54	143,744 11
Province Lands, . . .	Reclamation, . . .	68,000 00	—	58,115 83
Quansett harbor, Orleans, .	Survey, . . .	195 88	—	194 50
Quick's Hole, . . .	Survey, . . .	500 00	—	—
Revere, . . .	Stone breakwater, .	60,407 09	—	60,397 93
Rock harbor, Orleans, . . .	Dredging, . . .	5,401 33	—	5,385 79
Rockport harbor, . . .	Removing rocks, . .	8,000 00	—	7,319 70
Sandwich harbor, . . .	Survey, . . .	226 44	—	226 44
Saugus River, . . .	Survey, . . .	1,362 96	—	1,001 49
Scituate, . . .	Sea walls and riprap,	40,726 08	—	39,621 21
Scituate harbor, . . .	Dredging, . . .	6,975 05	2,000 00	8,975 05
Scorton harbor, Sandwich, .	Jetty and dredging, .	19,426 39	500 00	17,774 34
Sesuit harbor, Dennis, . . .	Jetty, . . .	19,484 05	1,000 00	20,466 30
Shirley Gut, . . .	Dredging, . . .	1,906 20	—	1,906 20
Sippican harbor, Marion, . .	Survey, . . .	7 17	—	7 17
Sippowisset, . . .	Survey, . . .	3 25	—	3 25
South Boston, southerly shore,	Dredging, . . .	126,972 48	—	126,972 44
South River, Salem, . . .	Dredging, . . .	5,097 67	3,000 00	8,097 67

APPROPRIATIONS, ETC. — *Concluded.*

LOCALITY.	Character of Work.	Total Appropriation.	Contribution by Municipality or Others.	Total Expenditure.
Stage harbor, Chatham, . . .	Dikes, . . .	\$9,231 93	—	\$9,231 93
Stony Beach, Hull, . . .	Sea wall, . . .	11,607 90	—	11,335 07
Taunton River, Dighton, . .	Survey, . . .	410 62	—	410 62
Taunton River — Boston harbor canal.	Survey, . . .	10,000 00	—	9,932 75
Vineyard Haven harbor, . .	Stone breakwater, . .	30,754 59	—	30,231 86
Waquoit Bay, . . .	Survey, . . .	1,000 00	—	701 61
Watch Hill, Chatham, . . .	Survey and riprap, . .	15,020 47	—	14,968 75
West Bay, Osterville, . . .	Jetties and dredging, .	45,460 82	—	45,423 45
West Falmouth harbor, . . .	Dredging, . . .	25,655 31	—	24,386 18
Weymouth Fore River, . . .	Dredging, . . .	38,991 19	—	24,066 70 ¹
Wild harbor, Falmouth, . . .	Breakwater, . . .	5,157 14	—	100 27
Winthrop harbor channel, . .	Dredging, . . .	18,959 21	\$700 00	17,704 63
Winthrop harbor, Cottage Park,	Dredging, . . .	6,603 00	—	6,581 66
Witchmere harbor, Harwich, .	Jetties and dredging, .	23,263 63	1,000 00	23,620 93 ²
Wollaston Beach, Quincy, . .	Dredging, . . .	15,666 00	—	14,644 61
Wrecks, . . .	Removal from tide water.	62,416 66	—	6,948 78
		\$1,738,227 13	\$222,422 17	\$1,724,514 28

¹ \$1.15 paid from small items appropriation.² \$3.64 paid from small items appropriation.

APPENDIX D.

CHANNEL DEPTHS OF PRINCIPAL HARBORS AND RIVERS IN MASSACHUSETTS, AS SHOWN ON UNITED STATES COAST SURVEY CHARTS.

LOCALITIES.	Depth at Mean Low Water (Feet).
Newburyport harbor,	11
Merrimac River,	7 ¹
Sandy Bay harbor,	45 to 90
Gloucester harbor,	15
Beverly harbor,	18
Salem harbor,	8 to 25
Marblehead harbor,	8 to 25
Lynn harbor,	15
Cohasset harbor,	6
Scituate harbor,	6
Plymouth harbor,	9
Cape Cod Canal,	25
Wellfleet harbor,	14
Provincetown harbor,	18 to 50
Hyannis harbor,	8 to 16
Vineyard Haven, Martha's Vineyard,	20
Edgartown harbor, Martha's Vineyard,	15
Nantucket harbor, Nantucket Island,	8 to 15
Cuttyhunk harbor, Cuttyhunk Island,	12
Hadleys harbor, Naushon Island,	12
Tarpaulin Cove, Naushon Island,	16
Woods Hole Great harbor,	13
Buzzards Bay, off Monument Beach,	12
Onset Bay, Buzzards Bay,	6 to 12
Wareham River, Buzzards Bay,	9
Marion harbor,	10
Mattapoissett harbor,	15
New Bedford harbor,	25
Fall River harbor,	25
Taunton River,	7
Connecticut River, in Connecticut,	12 ²
Connecticut River,	5 ³
Connecticut River, in Massachusetts,	7 ⁴
Port of Boston,	35

¹ To Haverhill.² To Hartford.³ At low-water periods in river above tidal influence (Hartford to Windsor Locks).⁴ At low-water periods in river above tidal influence (to Springfield and Holyoke).

INDEX.

INDEX.

COMMISSIONERS' REPORT.

	PAGE
Allens Harbor, Harwich,	31
Annisquam River,	11
Apponagansett Harbor,	31
Appropriation for Survey and Improvement of Harbors,	68
Barnstable Harbor,	32
Bass River, Beverly,	33
Bass River, Yarmouth,	12
Beaches,	73
Beverly Harbor,	13
Boston Harbor,	5
Bucks Creek, Chatham,	33
Buzzards Bay, Falmouth,	13
Cape Cod Canal,	74
Cataumet Harbor,	34
Centreville River,	35
Cohasset Harbor,	35
Concord River, Billerica,	14
Conclusion,	97
Connecticut River,	36
Cotuit Harbor,	38
Cuttyhunk Harbor,	14
Deacons Pond Harbor, Falmouth,	39
East Bay, Osterville,	40
Essex River,	41
Fish Weirs,	77
Great Ponds,	78
Green Harbor,	41
Harbor and Land Commissioners' Tide Water Fund,	9
Harbor Cove, Gloucester,	42
Haulover Beach, Nantucket,	21
Hearings, Inspections, etc.,	3
Herring River, Harwich,	16
Herring River Dike, Wellfleet,	43
Housatonic River,	78
Hull Sea Wall,	43
Humarock Beach, Scituate,	44
Hyannisport,	17
Improvement and Protection of Rivers, Harbors, Tide Waters and Foreshores,	4
Ipswich River,	45
Lake Anthony,	46
Lewis Bay, Hyannis,	48
Licenses granted during the year,	91
Little River, Gloucester,	18
Lobster Cove, Gloucester,	49
Lynn Harbor,	18
Manchester Harbor,	19
Massachusetts Atlas Sheets and Town Boundary Atlases,	90

	PAGE
Menamsha Inlet,	49
Merrimac River,	51
Mill River, Gloucester,	51
Miscellaneous Permits granted during the Year,	95
Nantucket Harbor,	21
Nontidal Rivers and Streams,	72
North River,	52
Oak Bluffs,	53
Onset Bay,	22
Pamet River, Truro,	23
Paskamansett River,	53
Penikese Island,	54
Plum Island River,	55
Plymouth Harbor,	23
Province Lands,	87
Quansett Harbor, Orleans,	55
Quicks Hole, Gosnold,	56
Revere Breakwater,	56
Rock Harbor, Orleans,	25
Rockport Harbor,	57
Salem Harbor,	26
Sandwich Harbor,	26
Saugus River,	27
Scituate Harbor,	28
Scituate Sea Walls,	57
Scorton Harbor, Sandwich,	59
Sesuit Harbor, Dennis,	60
Sippican Harbor, Marion,	61
South Boston, Southerly Shore of,	5
South River, Salem,	61
Stage Harbor, Chatham,	62
Taunton River, Dighton,	63
Taunton River-Boston Harbor Canal,	63
Town Boundary Survey,	88
United States, Expenditures on River and Harbor Improvements,	7
United States, Work of, in Rivers and Harbors of the Commonwealth,	68
Statement of Col. F. V. Abbot, Corps of Engineers, U. S. A.,	69
Statement of Col. John Millis, Corps of Engineers, U. S. A.,	70
Vineyard Haven Harbor,	63
Waquoit Bay,	65
Watch Hill, Chatham,	64
West Bay, Osterville,	65
West Falmouth Harbor,	66
Weymouth Back River Bridge,	96
Wild Harbor, Falmouth,	67
Witchmere Harbor, Harwich,	28
Woods Hole, Falmouth,	30

APPENDIX.

Appropriations, Contributions and Expenditures,	104
Channel Depths of Rivers and Harbors,	107
Contracts made and pending during the Year 1912,	101
Contributions and Expenditures under Chapter 481, Acts of 1909,	103

